MAY, 1952

# APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

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POWER PACKAGE GIVES NEW LIFE TO AN OLD MACHINE . 62

HOW TO DESIGN HYDRAULIC RESERVOIRS . . . . . 64

FEED DESIGN FOR MULTIPLE SPINDLE TAPPER . . . . 68

Listed on page 2 you'll find 11 articles and 7 regular departments which feature application and design ideas for fluid power equipment

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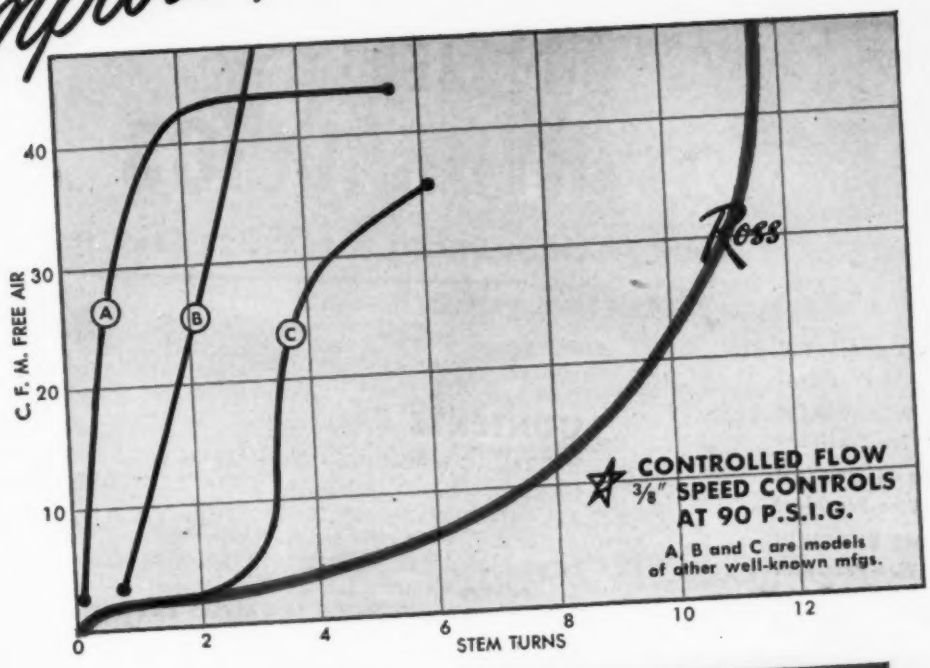


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MAY, 1952
Vol. 5, No. 5

# APPLIED HYDRAULICS

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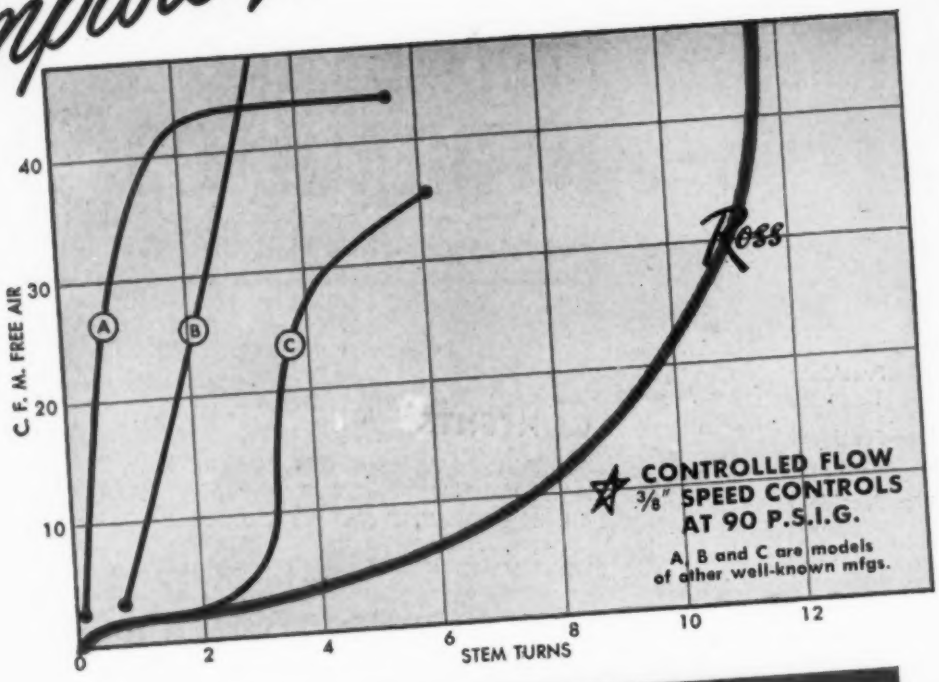


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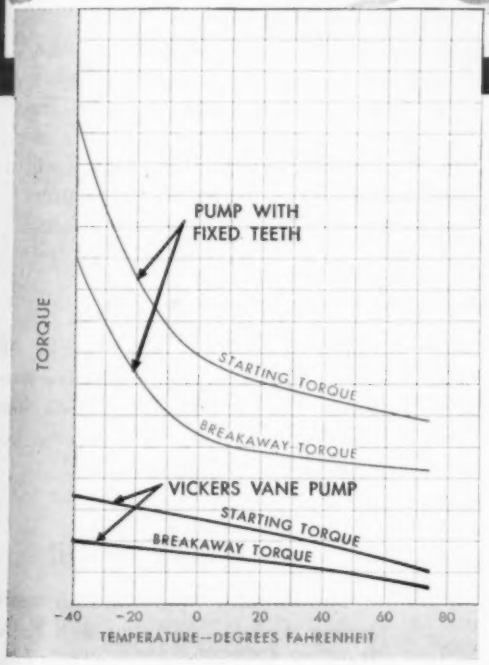


Curves based upon comparative tests of a Vickers Vane Type Pump and one with fixed teeth of equal capacity. Oil used complied with Army Spec. 2-79-B.

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# APPLIED HYDRAULICS Fluid Power Lines

### Reservoir Design

Speaking at an ASLE meeting in Cleveland last month, Jim Robinson, chief engineer for Vickers, Inc. said, "A hydraulic reservoir should be designed, not just thrown together for the purpose of giving the oil a place to stay, but designed with the purpose in mind of insuring that the associated equipment will not be caused to malfunction because of poor reservoir construction."

Part 2 of W. T. McCormick's series on "Good Practices in the Design and Construction of Hydraulic Systems" covers the reservoir experience which Mr. McCormick has had during his 15 years with the Caterpillar Tractor Company. He discusses: determining proper size, successful construction and adequate maintenance.

### Air Power in Foundries

Mechanization of foundry operation has made important gains in recent years. Much of the new equipment uses air as the power source for positioning and moving heavy flasks and controlling conveyors, furnace doors and sand hoppers. For many of these operations air is selected because the foundry already has a compressor station of adequate capacity which has been serving efficiently to operate rammers and vibrators.

Foundry applications, where there are hot areas, call for extra attention to safety. Fire and explosion hazard must be minimized. Air power is safe. Also the use of air prevents contamination of foundry material which might result from leakage if an oil system were used.

---

LEAKAGE CONTROL is the biggest problem confronting the user of hydraulic equipment. We're all "agin" leakage—but where do you begin on a control program? It's easy enough to say "Design the circuit properly. Use the correct packing. Give special care to the piping and fittings that you select." There's no doubt that leakage is costing a lot of dollars which could be saved. Some hydraulic machines never have the reservoir drained and refilled with new oil because makeup oil needed to replace leakage is so great that the oil never gets old enough to breakdown because of hard use.

Every month APPLIED HYDRAULICS has published application and technical articles which have shown how you can reduce leakage. Next month, R. W. Phillips, project engineer, with The Weatherhead Company, starts a series of articles on the proper installation of fluid lines in hydraulic equipment. The series will discuss tubing, hose and related fittings. This series will give practical information to fill an important part of your leakage control program.

---

In this issue, L. C. Cole, chief engineer, Machine Division, The Osborn Manufacturing Co., Cleveland, describes the operation and design of a completely automatic, pneumatically operated core making machine. This machine is a major step in the direction of fully automatic operations in foundries.

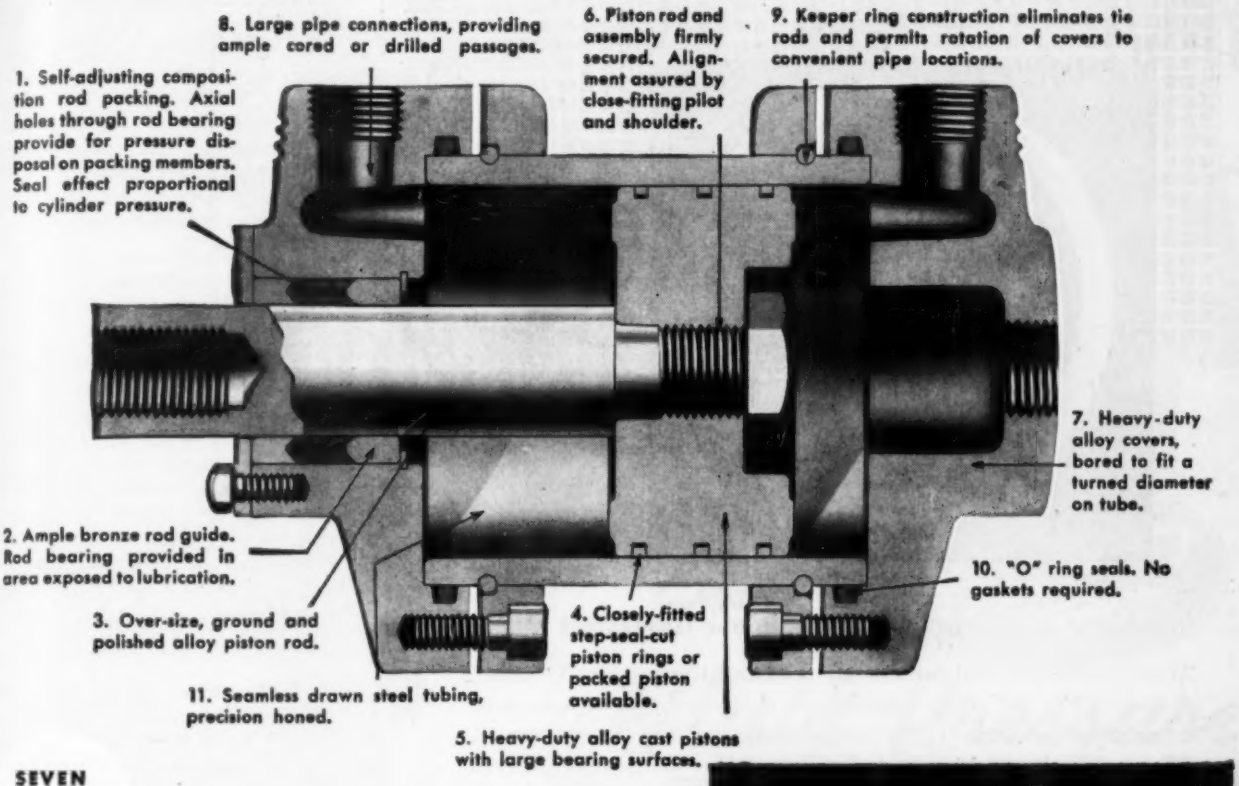
### New Power for Old Machines

When we saw the extrusion press described in "Power Package Gives New Life to Old Machine" in operation at the United States Asbestos Division of Raybestos-Manhattan, Inc. at Manheim, Pa., we felt that this was a solution to many of the production tie-ups which are resulting from long delays on equipment replacement. This old press was completely rebuilt to convert its operation from a slow speed water system to an oil powered unit which would provide a faster cycle. All the original machine members were used. The overhaul required new piping, repacking and a new hydraulic power package.

### Air Mixed in Oil

This month, in a comprehensive article, J. E. C. Stringer and K. N. Hastings of Vickers-Armstrong Ltd., England, describe the operating problems which result from air that is entrained or trapped in hydraulic oil. If you are responsible for the production or maintenance you will be particularly interested in the venting valve which they describe for the removal of trapped air from a circuit. For design and development men who have worked on the problem of measuring air and oil, the authors describe instruments and tabulate results of their own work on this project.

# More Power to You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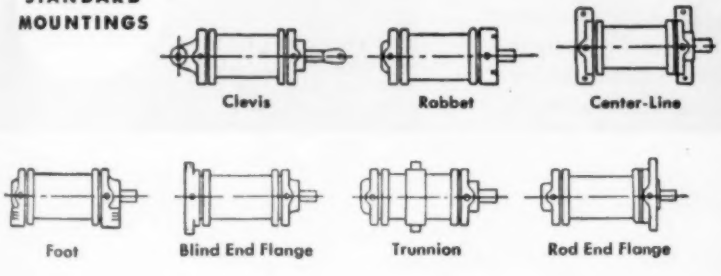


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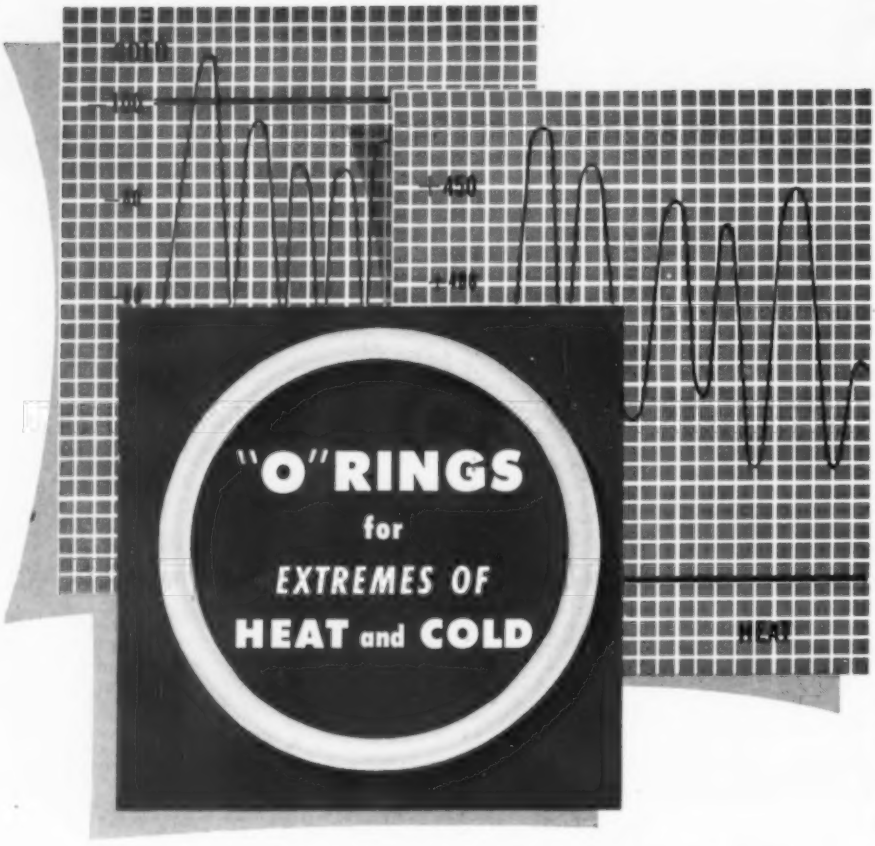


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# LETTERS to the Editor

I wonder if it would be possible to obtain reprints of the articles, "A Beginners Course in Basic Hydraulics" for May and August 1949 and for January 1951, which are missing from my set in spite of my efforts to maintain a complete file.

W. M. KEIL, P.E.,
*Chief Draftsman,*
*The Youngstown Foundry & Machine Co.*

*Fortunately, we have been able to find tear sheets of the installments missing in your file. They have been sent to you. Very few and far between are issues still on hand with installments of this series. A note elsewhere in this column gives information on reproduction of complete sets of "A Beginners Course in Basic Hydraulics".*

---

Please send a set of tear sheets of the article "How Much Air?" by Ralph E. Middleton which appeared in the March issue of APPLIED HYDRAULICS.

G. W. BAUGHMAN,
*Staff Specialist,*
*Department 72-04,*
*Lockheed Aircraft Corporation,*
*Georgia Division,*
*Marietta, Ga.*

*Tear sheets of "How Much Air?" have been sent to you. Because of the number of requests that have been received for this article, it will be held for possible reprinting for at least 30 days.*

---

We are greatly interested in the booklet "Corrosion Resistance of Copper and Copper Alloys" which we noted was briefly described in the December issue of APPLIED HYDRAULICS. We would like to obtain three copies.

KAY & CO. (ENGINEERS) LTD.,
*Bolton Brass Works,*
*Blackhorse St.,*
*Bolton, Lancs., England*

*Your request was forwarded to the home office of the American Brass Co., Waterbury 20, Conn., from whom you have doubtless received the booklets.*

Continued on page 42

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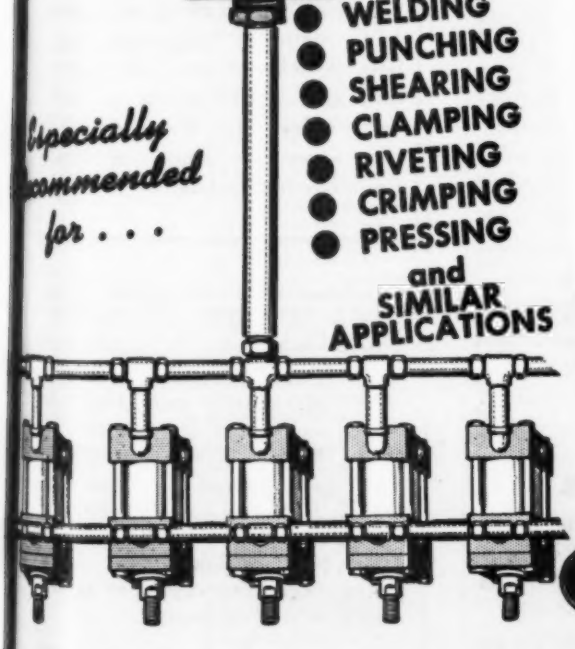

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## Letters to the Editor

Continued from page 38

We would like to have the names and addresses of the publishers of the following books listed in your Data List: "Torque Converters or Transmissions", "Hydraulic Equipment", "Machinery Handbook" and "Positive Displacement Pumps and Fluid Motors." Thank you.

J. H. WORDEN,
*Forano Limited,*
*Montreal, Que., Canada*

*"Torque Converters or Transmissions" is published by the author P. M. Heldt, Nyack, N. Y.; "Hydraulic Equipment" is a publication of Shell Oil Co., 50 W. 50th St., New York 20, N.Y.; "Machinery Handbook" is published by The Industrial Press, 148 Lafayette St., New York 13, N.Y.; and "Positive Displacement Pumps and Fluid Motors" is published by Pitman Publishing Corporation, 2 W. 45th St., New York 19, N.Y.*

### "KNOW YOUR COMPONENT SYMBOLS"

APPLIED HYDRAULICS has just published a twenty page handbook which reprints the component series that ran monthly last year. Typical cross-sectional drawings of relief, sequence, counterbalance, unloading, check, flow control, directional, and pressure reducing valves are shown along with their J.I.C. standard component symbols. A description of the operation and application of each valve is included. Write to us for your copy of "Know of Your Component Symbols".

Please send two copies of the 1952 APPLIED HYDRAULICS Data List.

W. S. KLECZEK,
*Aeronautic and Ordnance Systems Department,*
*General Electric Company*

*Two copies of the Data List have been sent to you. We still have on hand a limited supply of the 1952 edition of the Data List, individual copies of which will be sent on request.*

Continued on page 51

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# *What's Being Said About J.I.C. Hydraulic Standards?*

*A few days before this issue went to press we attended the Hydraulic Forum session at the seventh annual meeting of The American Society of Lubrication Engineers. The Forum, with Don Morrell, Supervisor, Fluids and Electrical Section, Manufacturing Engineering Office, Ford Motor Company, as chairman, presented a progress report on J.I.C. standards. Here, briefly from our notes, are the highlights of the discussion.*

**James Robinson,** Chief Engineer, Vickers Incorporated . . . *the hydraulic equipment manufacturer's viewpoint*

Based on sound engineering principles, the J.I.C. standards have initiated many advancements. The standards introduce the thinking of the ultimate user of hydraulics into the minds of the designers of hydraulic equipment.

**Valve design**—Although the internal working parts are unchanged, the design of many relief valves has been altered in terms of external shape and form to suit suggestions made by the J.I.C. standards. The changes suggested by the J.I.C. were in recommending the use of what are commonly called gasket mounted valves. The gasket mounted design enables valves to be removed without disturbing any of the plumbing in the circuit. The type of gaskets used are generally the synthetic rubber type of either "O" ring or pressure expanding type of seal.

For electrically actuated directional valves, the use of gasket mounted construction is proving invaluable as compared to older piping methods. They can actually be gasketed one to another to combine several functions without the obvious disadvantage of miles of spaghetti. The same is true of other types of hydraulic components, such as volume regulators or control assemblies having several functions within them which control, in many cases, both direction and volume.

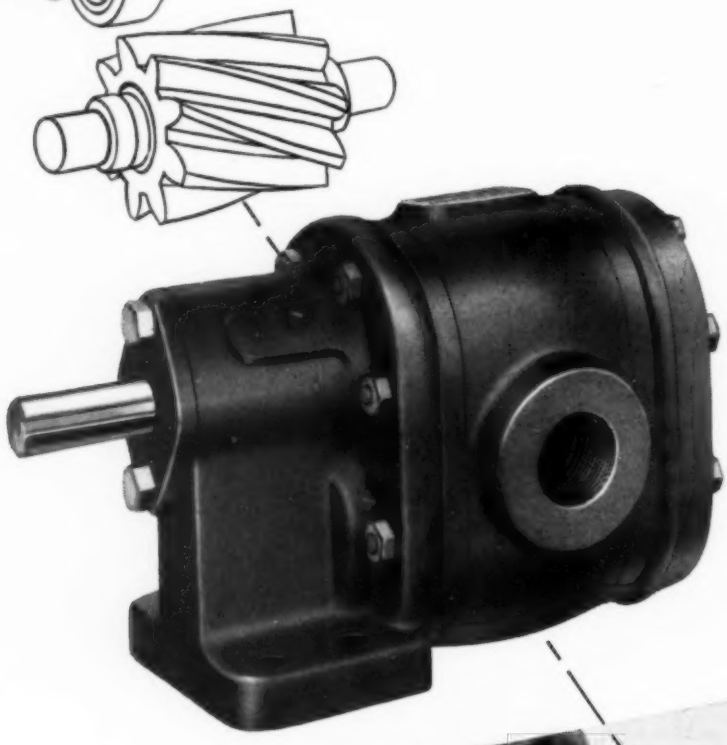
**About pumps**—Before standards, many machine tool designers imbedded the pump deep inside the machine where accessibility was practically impossible. Even to ascertain what type of pump was used was a cumbersome and difficult task. Although the accessibility of components is a responsibility of the machine tool builder, the equipment manufacturers, in complying with the J.I.C. standards, can supply duplicate name plates which can be mounted outside of the pump compartment. This eliminates the necessity of tearing the machine apart to find out what type or size of pump is used.

**Reservoir design**—Probably as much time and thought was spent by the J.I.C. group in the discussion of oil containers, more commonly called oil reservoirs, as with any other piece of hydraulic equipment. Poor design of an oil reservoir has been known to be the cause of many failures in other components, even to the extent of the condemnation of all forms of hydraulics. An oil reservoir must be designed properly. Reservoirs are not the type of thing that you would put on display as work of art—but they ought to be, and it is believed the majority have been redesigned to be works of art from the engineering standpoint in making them better suited to do the desired work.

**Circuit symbols**—The symbols adopted by the J.I.C. have been extremely beneficial in the portrayal of diagrammatic machines. The older method of attempting to make a miniature picture of the outside of a valve or the type of control was very simple to those who were familiar with the inside of the valve. The new symbols, which graphically portray the operation of the valve, make circuit following and circuit analyzing much simpler and more easily

Continued on page 124

# Smooth-operating quiet hydraulic systems start here



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## Letters to the Editor

Continued from page 42

We found the series of short articles on "Know Your Component Symbols" which you ran last year very interesting and useful. Do you plan to reprint these?

M. A. ANDREWS,
*Design Engineer,*
*Hughes Aircraft Co.,*
*Culver City, Calif.*

*Yes, we do, due to the considerable interest exhibited by our readers. The series, which ran throughout* 1951, *is in the process of being reproduced. Copies should be ready for distribution by the time this issue is delivered. A copy of this booklet will be sent to you.*

---

We are interested in obtaining information relative to the names of manufacturers who are presently producing piston type accumulators similar to those outlined by Mr. M. J. Phillips in his article in the February 1951 issue of APPLIED HYDRAULICS.

HAL ROGGE
*Project Engineer*
*Lamb-Grays Harbor Co., Inc.,*
*Hoquiam, Washington*

*The manufacturers of piston type accumulators include: Pacific-Bendix Division, Bendix Aviation Corporation, North Hollywood, Calif.; The Parker Appliance Co.,* 17325 *Euclid Ave., Cleveland* 12, *Ohio; Sprague Engineering & Sales,* 1144 *W.* 135*th St., Gardena, Calif.; Simmonds Aerocessories, Inc.,* 105 *White Plains Rd., Tarrytown, N. Y. and Superior Pipe Specialties Company, Cicero, Ill.*

---

Please send us several reprints of your articles "A Beginners Course in Basic Hydraulics" for distribution to some of our key plant personnel.

EUGENE A. GLASSNER,
*Vice President,*
*Russell Reinforced Plastics Corp.,*
*Hicksville, L.I., N.Y.*

*We did not plan originally to reprint this series. However, the great interest shown in it continues since its completion in the December* 1951 *issue. The series is being photostated and made into a stapled binder form. We will announce in this column if and when photostats will be available.*

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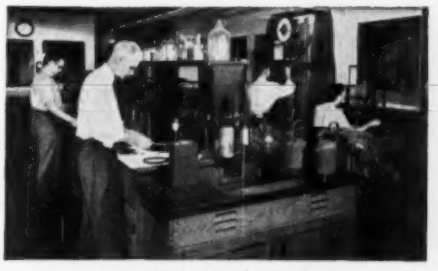

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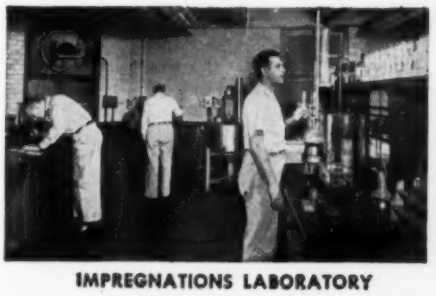

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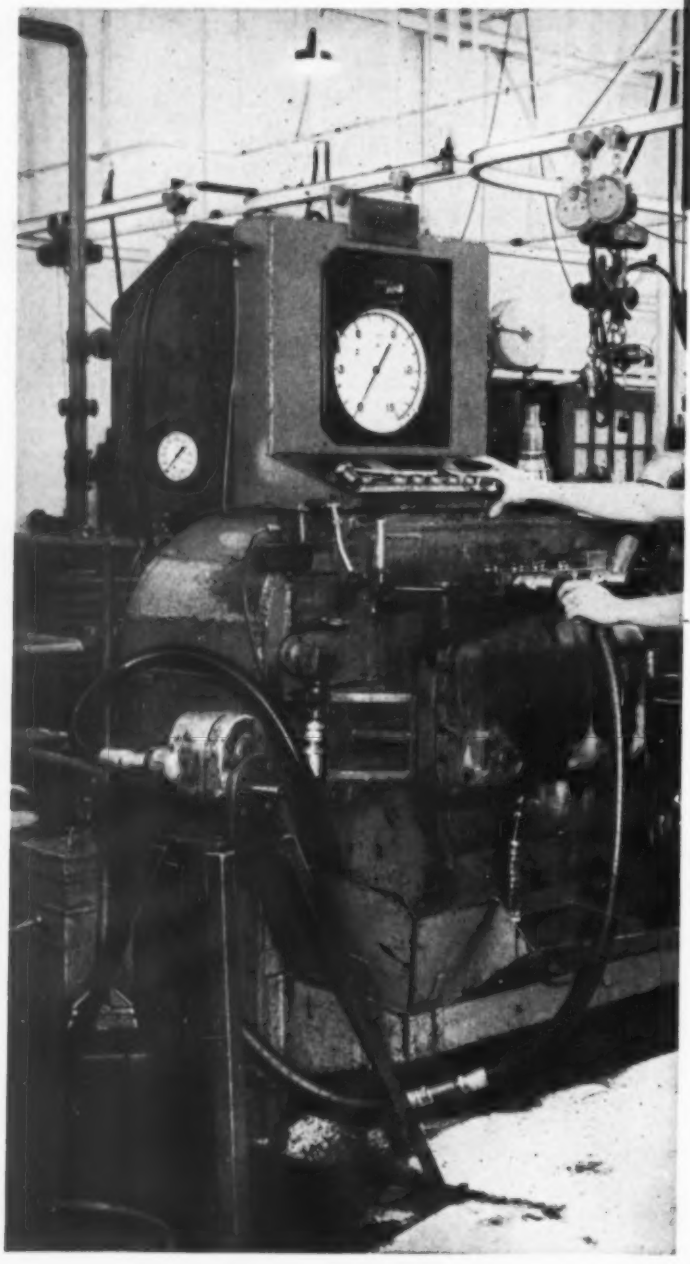
# HYDRAULIC TESTING: ACCURACY ASSURED



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For this testing machine to function accurately, its hydraulic system must be kept free of rust, sludge and foam. Best way to do that, the owner* has found, is to use *Texaco Regal Oil (R & O)* as hydraulic medium.

*Texaco Regal Oil (R & O)* is a turbine-quality oil, specially refined and processed, and fortified with special additives. *It is more than ten times as oxidation-resistant as ordinary hydraulic oils* and gives superior protection against rust and sludge. It will not foam.

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*Name on request

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# Hydraulic Machines Dominate In New Engine Plant

THE new De Soto engine plant in Detroit in which the new Fire Dome V-8 engine is made is remarkable in several ways—everything in the plant is new; a very high percentage of operations are completely automatic, including material handling, gaging and inspection as well as work operations; and virtually every production machine incorporates hydraulic circuits for actuation or control of its operations. The plant is being given wide publicity in the general press as a "pushbutton" plant.

The plant is housed in a section of the De Soto body plant. With a completely new group of production machines—with many of the most modern transfer and other automatic machines in evidence—production engineers had a free hand in working out a highly efficient floor plan. Major work lines for cylinder block, cylinder head, crankshaft, camshaft, piston machining and other related groups of operations were provided. Straightline progression of operations is carried out. The cylinder block line required that two lines of transfer machines be used, down the length of the plant and back again.

### *Cylinder Block Operations*

A series of automatic transfer type machines, all with work heads that are hydraulically fed toward the work, do the rough, semi-finish and finish milling, drilling, boring and other operations on the cast iron cylinder blocks. An Ingersoll thirteen station machine, Figure 1, accepts the block, pan face down and begins a series of milling, boring, drilling and reaming operations as the block is automatically moved from station to station. On occasion the block is indexed, clamped and position controlled or turned over.

Further along, the block has been turned over again and tapping operations in the top and block faces are performed on the Greenlee transfer machine. Tapping heads for the block faces are shown toward the rear (Figure 2).

Near the end of the cylinder block line, the cylinder

**Fig. 1. AN OPERATOR** is starting a cylinder block through the first station of the 13-station Ingersoll automatic transfer machine. Behind the first station is the tumbler which turns the block over for the drilling, chamfering and counterboring of holes on the pan face.

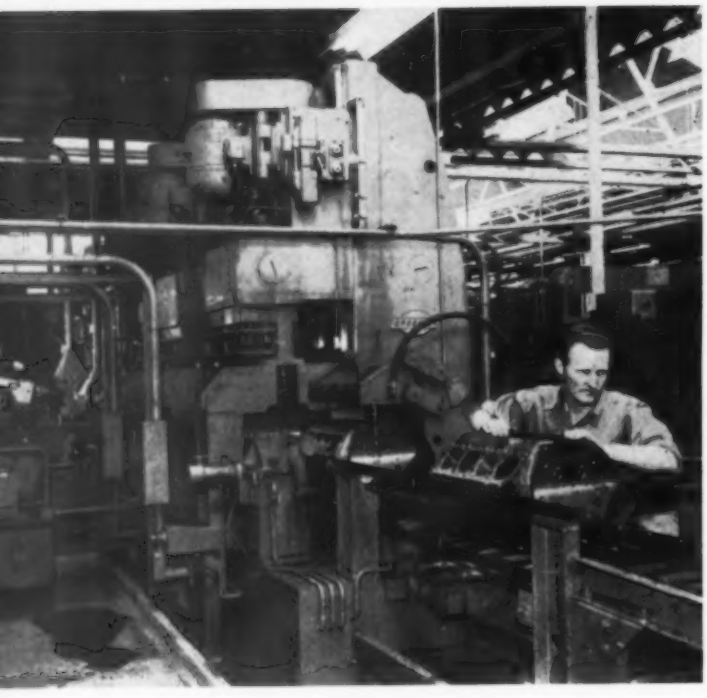
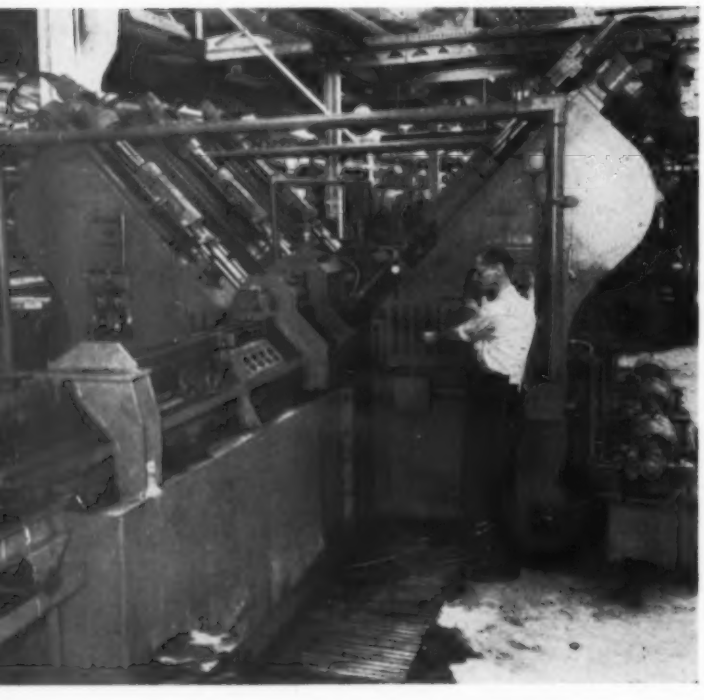


Fig. 2. FURTHER ALONG, tapping operations are performed in the top and block faces in this Greenlee transfer machine.

Fig. 3. NEAR THE END of the engine block line, a Micromatic home imparts a series of three precision finishing operations to the cylinder walls.



walls are honed on a Micromatic machine. (Figure 3).

On the Greenlee transfer machine which picks up the cylinder block from the last Ingersoll station, drilling, countersinking and counterboring on the top, bottom, sides and end surfaces of block are done. Miscellaneous holes for main bearings, distributor shaft, oil filter, oil pumps, etc. are machined farther along.

### *Cylinder Head Operations*

An outstanding piece of hydraulically actuated equipment—a Cincinnati two-way horizontal broaching machine (Figure 4) is used for broaching the top, bottom, intake face and exhaust face of the cylinder heads. On the movement in one direction, two surfaces are rough and finished broached. At the end of the stroke, the work holding fixture is automatically transferred to the second station and the head is rotated 180 degrees; on the return stroke the other two surfaces are broached. The machine is capable of a production of 120 heads per hour.

Figures 5 and 6 show a front and side view of the special Ex-Cell-O four-station indexing machine on which piston wrist-pin holes are rough and finish bored and grooved and the piston skirts are turned eccentrically. There are three fixtures at each station. The first station is the loading and unloading station; at the second station the wrist pin holes are rough bored and grooved; at the third station the piston skirts are turned eccentrically (vertical offset spindles); at the fourth station the wrist pin holes are finish bored. The hydraulic cycle is completely automatic, the operator merely loads and unloads pistons at the first station.

Another marked advance is the equipment for measuring and correcting unbalance of crankshafts. This consists of two Gisholt unbalance measuring machines which have correction drilling units built in. In the first machine, the unbalance is measured and the crankshaft is then transferred to the drill unit, the depths of cuts of which are set automatically. The machine is set to deliberately produce a small unbalance. The normal unbalance which has a magnitude of 14-17 in. lbs. on entering the machine is reduced to an average of 2½ in. lbs. by the corrective drilling. The crankshaft is then automatically transferred to the second machine where the unbalance is again measured and the final corrective drilling is done.

### *Final Assembly*

The finished parts move toward the end of the plant to the final engine assembly conveyor; feeder lines deliver components and subassemblies from the machine shop. On the final engine assembly line, the cylinder block is delivered first, then the crankshaft, rod and piston assemblies, heads, intake manifold, transmissions are assembled in turn. At the end of the line, the engine is transferred to a monorail conveyor, spray painted, air dried and the electrical assemblies added. From storage racks the engines go to special test stands where an automatic cycle test of 5 minutes at low speed; 12 minutes at 800 rpm and one-half load; and 3 minutes at 1250 rpm and full load is made.

The capacity of the plant is 60 engines per hour.

Fig. 4. A CINCINNATI TWO-WAY horizontal broaching machine in which top and bottom surfaces, intake and exhaust faces of cylinder heads are rough and finish broached in one cycle. One surface and one face are broached on each stroke.

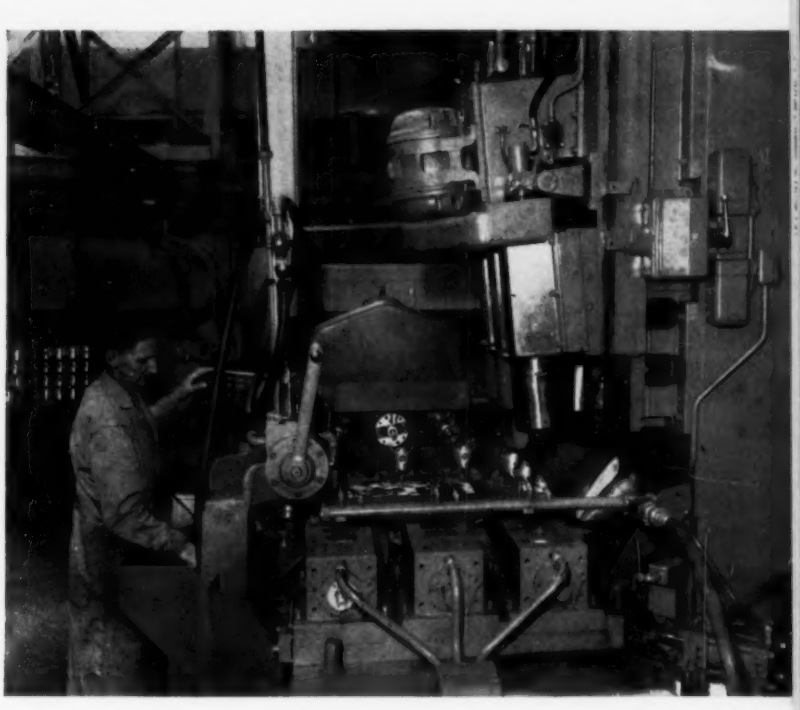


Fig. 6. SIDE VIEW of the indexing machine. The index table carries the work to the three stations then back to the first station for unloading. Twelve fixtures, three at each station, permit a production of over 400 pistons per hour.

Fig. 5. FRONT VIEW of the special Ex-Cell-O four-station indexing machine on which piston wrist pin holes are rough and finish bored and grooved and the piston skirts are turned eccentrically.

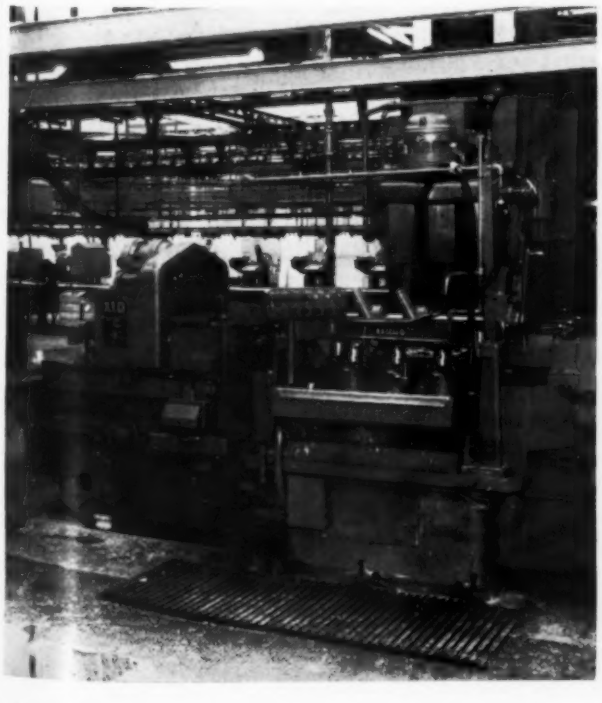
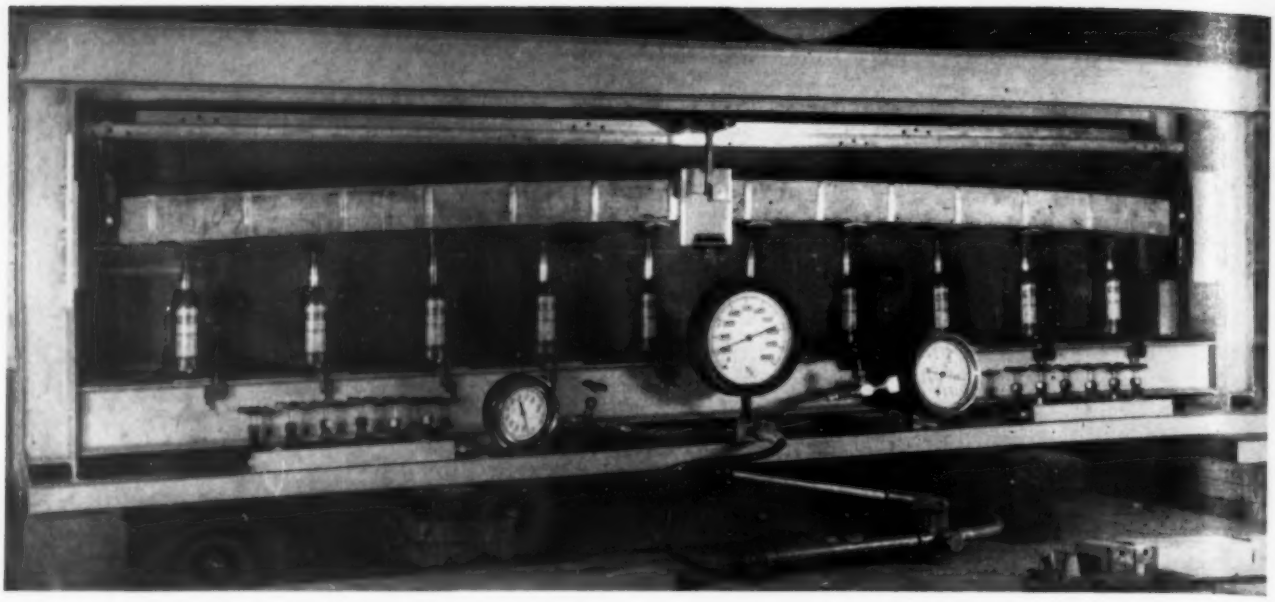
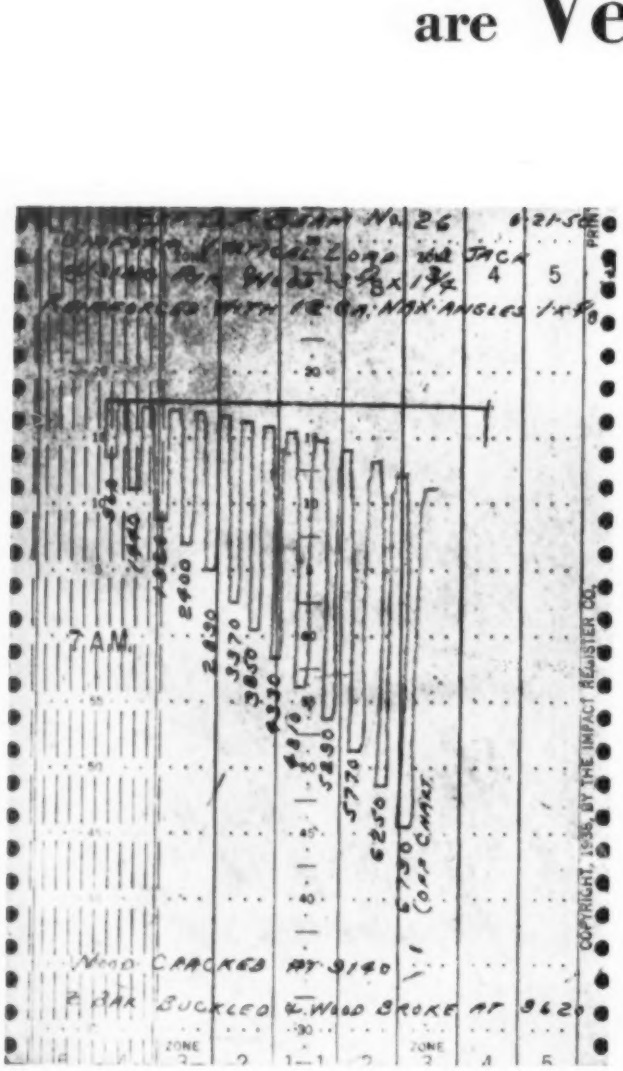


Fig. 7. THE LOADING end of the automatic crankshaft balancing machine. Two hydraulic cylinders lift and index the crankshafts into the machine.



# Hand Pump and Jacks are Versatile Test Tools




A LARGE variety of tension and compression tests can be economically performed by applying simple hydraulic jacks supplied with power by a hand pump.

The beam test machine shown above has proved valuable in experiments conducted by the Evans Products Company, Plymouth, Michigan.

The beam being tested in the photo here is an experimental cross member of the Evans DF Loader. These cross members lock into longitudinal car wall members to secure lading against shifting while the shipment is in transit. Evans wanted a test set-up which would simulate the many different loadings which these beams are subjected to in use. By applying 10 hydraulic jacks which can be operated independently by the use of needle valves, any loading variation is available.

Several very important benefits are realized from the use of the test machine. First, it has provided a great many answers in the development and design of the DF Loader. Second, it is regularly used as a part of Evans' quality control program.

By substituting two large jacks for the 10 small ones, stress tests can be run on cross members where uneven pressures are anticipated.

Tests determine rupture point of various materials, loadings and design. Also conditions of permanent set are recorded. The chart at the left is an actual test tape. The bars on the tape graphically show deformation for each load.

*Here is a discussion of the circuit problems resulting from trapped air. You'll find a practical method for measuring air in oil and methods for removing air from hydraulic pipes.*

# Trapped Air in Hydraulic Systems

By J. E. C. Stringer and K. N. Hastings

BECAUSE air in hydraulic systems causes erratic operation, it is the aim of the oil producer and the machine user to have as little air in the oil as possible. Air may be entrained in the oil motion in a hydraulic system as for example, in a variable speed power transmission unit comprising a variable displacement pump driving a hydraulic motor, or the air may be actually dissolved in the oil. In either case its presence is undesirable because:

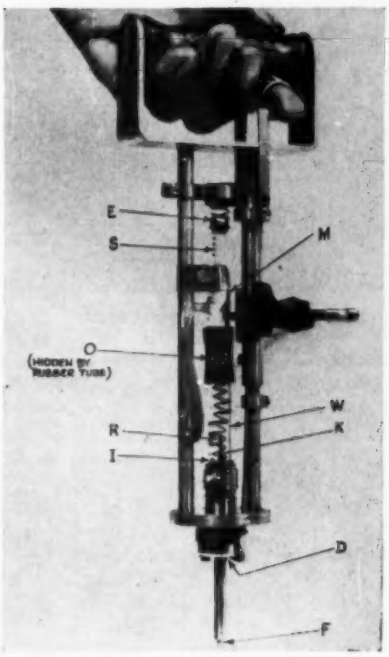
1. Air is highly elastic so that if air is mixed with oil, the specific compressibility of the oil is increased, which means that the "hydraulic stiffness" of a power transmission unit will be reduced; in some cases, where entrained air may be present as well as dissolved air, to such an extent that persistent hunting or surging will occur.

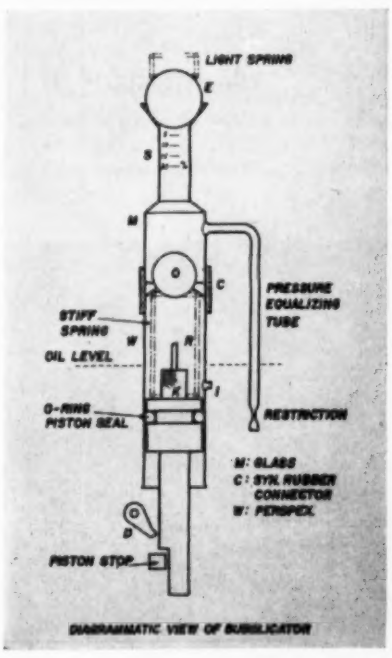
2. Further, because air is elastic, the volumetric efficiency of such a unit, operating with aerated oil will be lowered. This can be serious in high pressure pumps.

3. In hydraulic circuits such as servo systems, dashpots are commonly used, the general air being that the viscosity-damping qualities of the oil should tend to restrain any large rapid dashpot piston movements. If there is dissolved air in the oil, the vacuum produced by the piston movement may be sufficient to extract air from the oil. This air will then act as an elastic cushion which will partly rob the dashpot of its damping characteristic and replace it by a certain amount of springiness—quite the reverse of the action desired.

4. The oxygen associated with any air present in the oil causes oxidation with deterioration of the oil due to increase in acid value and the formation of sludge. (The formation of sludge is also tied

J. E. C. STRINGER and K. N. HASTINGS, Vickers-Armstrong Ltd., Elswick Works, Newcastle-upon-Tyne, England.




**Figs. 1 and 2. THE AMOUNT** of air in an oil sample is successfully measured by the use of the "Bubblicator". A series of extractions at increasingly high vacuum may be made.

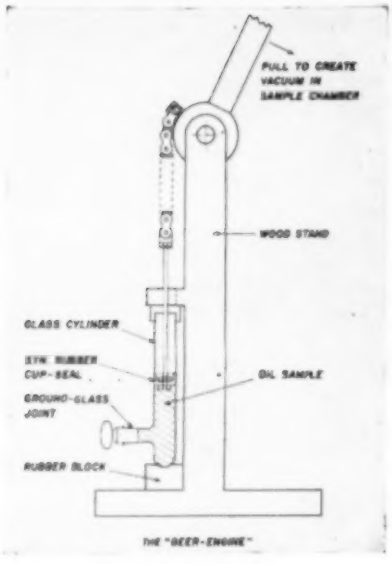



**Fig. 3. PRELIMINARY** instrument designed for measuring air in oil. Because a single suction stroke did not produce enough vacuum to extract all the air from the oil this "Beer Engine" was unsatisfactory.

**TABLE I Some typical measurements which have been made using the Bubblicator.**

| Oil Type | Manufacturer | Condition | Oil Tem. °F. | Rm. Tem. °F. | Source of Sample | % Vol. Air Content |
|---|---|---|---|---|---|---|
| Univis 54 | Esso | New | 66 | 65 | Drum Oil Store. | 12 |
| Tellus 27 | Shell | New | 66 | 65 | Drum Oil Store. | 12 |
| OM. 35 | Shell | Reclaimed* | 71 | 70 | Drum Oil Store. | 8 |
| OM. 65 | Rimer | Reclaimed* | 68 | 68 | Drum Oil Store. | 8 |
| OM. 88 | Shell | New | 69 | 69 | Drum Oil Store. | 10 |
| OM. 88 | Wakefield | New | 69 | 69 | Drum Oil Store. | 10 |
| OM. 88 | Vacuum | New | 70 | 70 | Drum Oil Store. | 10 |
| OM. 65 | Rimer | Reclaimed* | 70 | 70 | Header Tank Rig 16. Pre-run. | 7 |
| Same | Rimer | Reclaimed* | 121 | 69 | Rig 16 after running 1½ hrs. Header Tank. | 10 |
| OM. 65 | Rimer | Reclaimed* | 92 | 70 | Rig 8. after running 1½ hrs. on Shop Oil supply. | 9 |
| OM. 65 | Rimer | Reclaimed* | 70 | 70 | Rig 6. Header Tank. Pre-run. | 5 |
| Same | Rimer | Reclaimed* | 70 | 70 | After 10-hrs. run then standing 2 days. | 10 |

* *Oil reclaimed by centrifuging.*

up with the presence of water and catalysts, composed of finely divided metal and oxides, abraded from the machine parts during normal running.) *

### *Measurement of Air in Oil*

Our first attempt to measure the amount of air in hydraulic oil was made with the apparatus shown in Figure 3, nick-named "the Beer-engine" from the mode of its operation. To use it the glass cylinder was laid horizontally, with the piston at the "in" end of its stroke, the cylinder then being filled with the oil to be tested and the stopper placed in position. The apparatus was then placed vertically and the piston (oil sealed) drawn upwards by pulling the handle, so as to create a vacuum. This produced a cloud of tiny bubbles throughout the oil, which after a minute or so, coalesced into a single large bubble. The piston was then allowed to return, so that the bubble was compressed back to atmospheric pressure; its volume could then be gauged and the percentage of air originally in the oil deduced.

Unfortunately it was found that a single suction stroke did not produce a sufficiently high vacuum to extract all the air from the oil and for this reason the "beer engine" had to be abandoned.

An improved instrument is shown in the photograph Figure 1 and schematic diagram Figure 2. In the "Bubblicator" a series of extractions at increasingly high vacuum may be made on the same sample of oil.

### *Using the Pumping Action of the Instrument for Self-filling*

The instrument is immersed in the oil sample to a depth sufficient to cover the side hole I; the detent D is held off (by the finger grip under the handle); the handle and whole instrument resting on the foot F of the piston is pressed down, compressing the spring and driving air out of working chamber W past the trap valve O; upon letting the handle rise, the spring pushes the piston down creating a partial vacuum in W which causes oil to enter the side hole I.

The handle is depressed and raised several times so as to completely fill W and the measuring chamber M above it; oil will be seen to overflow past the exit valve E.

### *Using the Filled Instrument to Determine the Air-content of the Oil Sample*

With the handle depressed (i.e. piston in "UP" position) the detent D is released and the handle raised; the spring forces the piston down part-stroke (i.e. not so far that the side hole I is uncovered) and the trapped volume of oil is subjected to vacuum. The knurled surface K provides nuclei for the formation of air bubbles which rise to the top of W and, in about a minute, coalesce into a single large bubble.

The handle is depressed; the piston rises and the air bubble is compressed back to atmospheric pressure; at the same time, the rod R rises and lifts the trap valve O so that the bubble may rise into the measuring chamber M.

* *See "Oxidation of Hydraulic Oils" by J. Theodore Wolff, April, 1952, APPLIED HYDRAULICS.*

Concluded on page 112

# HOW AIR CYLINDERS CONTROL FLOW

## in a water filtration system . . .

THE newest major plant in Cleveland's water supply system, the Nottingham Filtration Plant, with a nominal capacity of 100,000,000 gallons per day, was put into service last October. The third filtration plant in the city's system, the plant supplies water for both industrial and residential areas on Cleveland's east side. Wherever possible, water hydraulic cylinders are used to actuate valves and gates for flow control throughout the plant. In the two filter galleries, low pressure ¾ inch, four-way, all bronze valves control the operation of double acting water cylinders which open and close intake and drain gates for the normal filtration and back wash operations.

The filter building is divided into two parallel galleries of 12 filter beds each. Each filter has a rated capacity of 4 and a quarter millions of gallons per day, at an average rate of filtration of 2 gallons per square foot per minute. This rate is constant, regardless of the relative freedom of water to pass through the bed. A pneumatically operated controller opens and closes a butterfly valve in the filter bed in-feed line, the proportional type actuator delivering less water when the filter beds are freshly cleaned and more as the entrapped sediment slows the filter action.

The water delivered to the filter bed intake or supply gate has already been pre-chlorinated, treated with alum and activated carbon, mixed in flocculation basins and held in settling tanks. This series of treatments and operations has eliminated bacteria and approximately 75 percent of the solids originally in the raw water. When seasonal conditions require, further additions of chlorine and activated carbon are added to the clarified water as it leaves the settling basins for the filters.

The filter beds consist of a series of small pyramidal pockets, containing fourteen porcelain spheres each, larger spheres at the bottom. Above the top layer of small spheres are five layers of graded gravel, each three inches thick, sized from 1½ inches to 3/32 inches in diameter. The top layer of the filter bed consists of a 27 inch blanket of very fine silica sand, the top two feet of which can vary on 1/10 of a millimeter in size.

Each filter is equipped with a revolving sweep surface wash with six sweeps per filter. The water for the sweeps is provided by two stage centrifugal pumps, automatically controlled by pressure. Two pumps are provided, one for each gallery, but available for either gallery.

To operate a filter bed, the valves on the control table are set manually. The valves, operating from a manifold, control the actuation of two double acting water cylinders, mounted vertically at the end of each filter above the upper intake gate and lower drain gate. As the smaller cylinder opens the intake gate, water is delivered by gravity from the settling basins. For the back wash operation, the larger cylinder opens and closes the drain gate. The valves operate

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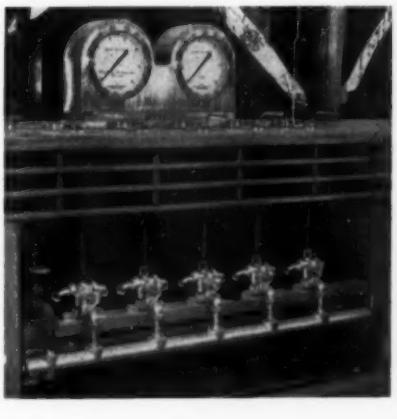
**A GENERAL VIEW** of one of the two galleries in the Filtration Plant, each of which has twelve table control stations. One operator normally can take care of all 24 table stations.



**CLOSE-UP OF ONE** of the tables from which water flow control valves in the Nottingham Filtration Plant are operated. Five valves with a manifold provide flexible and sensitive control for the double acting cylinders which open and close intake and drain gates. Rate of flow and loss of head gauges are shown.

*Pineapples, fresh from the field, enter one end of the cannery while fruit juices leave at the other end. Oil pressure is used to lift heavy loads and power conveyors. Air cylinders are automatically actuated to move gates which control the flow of fruit through the plant. The application of fluid power to this difficult handling problem resulted in . . .*

# Handling 300 Tons of Pineapples

## each hour in world's largest fruit processing plant

IN the Honolulu cannery of the Hawaiian Pineapple Co., the world's largest fruit processing plant, key applications of hydraulics make possible marked labor savings and give swifter handling of field-fresh "king of fruits". The flow pattern, by which up to 300 tons of pineapples per hour are handled, is set and controlled by hydraulic circuits. One important operation —controlling the movement of pineapples into the special coring machines or ginacas—is air controlled. The huge cannery is a complete processing plant; the pineapples, fresh from the fields, enter at one end and cases of fruit and juices as well as the waste (dehydrated bran, a staple livestock food) discharging at the other end.

The pineapples are transported to the cannery by highway type semi-trailers, each carrying two 7½ ton bins. Straddle trucks transfer the bins to positions in front of the dumping conveyors. Hydraulic lift cylinders tilt the bins, permitting the fruit to slide out onto a slat conveyor.

The slat conveyor forward speed is adjustable, being driven by a hydraulic motor. The entering end of the slat conveyor is elevated and depressed by hydraulic lift cylinders. The operator from his control position near the discharge end of the slat conveyor regulates the angle and speed of the conveyor to synchronize the rate of fruit discharge to the longitudinal grader rollers as required.

After the bin has been emptied, the end gates are closed and the bin is lowered to a moderate angle. Buffer pins in front of the bin are withdrawn and the bin moves by gravity onto the slat conveyor. This is raised so that the empty bin passes over the grader and onto gravity rollers. The bin moves to the end of the gravity conveyor where it is picked up by a straddle truck and loaded on a semi-trailer for return to the plantation.

### *Eight Separate Hydraulic Systems*

The hydraulic system supplying each of the eight dumping stations consists of a 15 hp multiple pump unit with a double vane 17 gpm pump and a single vane 7.5 gpm pump mounted on a 60 gallon reservoir. Operating pressure is 1000 psi. Each control station operates the dumping lift, the slat conveyor lift and drive for two dumping lines.

From the slat conveyor the pineapples drop onto the grader rolls. These are mounted immediately below the gravity rolls over which the empty bins pass. The grader rolls are 1-15/16 inch steel shafts, spiral wound with 3/16 inch wire; the shafts are driven in pairs; the left shaft rotating counterclockwise, the right clockwise, with the spiral pitch increasing toward the discharge end to separate each pineapple. The smaller fruit falls between the shafts onto a 48 inch conveyor belt. The larger fruit (destined for coring and slicing in a #2½ size can) rides freely between

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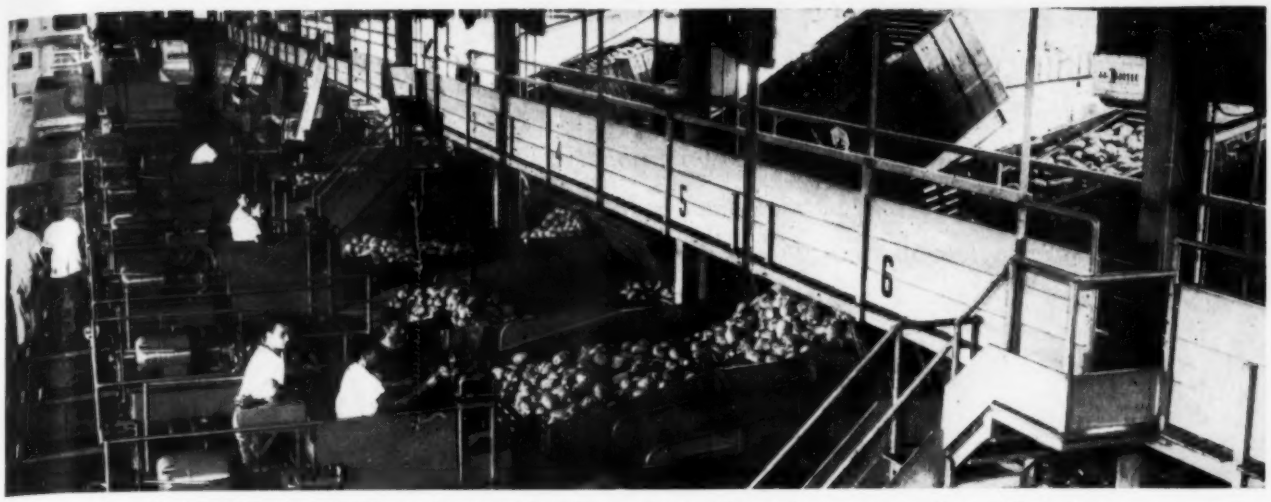
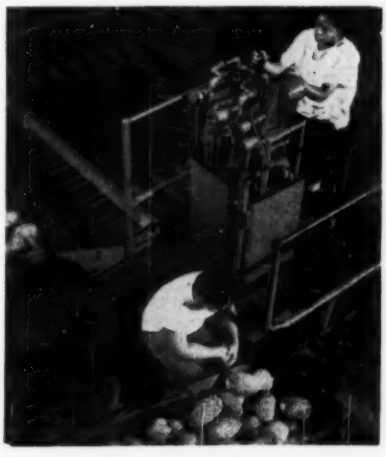


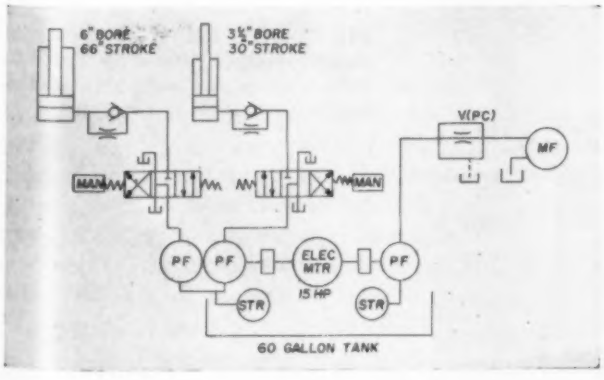
**A GENERAL VIEW** of the dumping lines at the Honolulu cannery of the Hawaiian Pineapple Co. The tilting of the bins, the speed and elevation of the in-feed slat conveyors are controlled hydraulically from the pulpit stations, each station controlling two dumping lines.

**THE RATE AT WHICH** the pineapples pass over the in-feed slat conveyor is controlled by the angle of the conveyor (tilt cylinder on entering end) and the speed of the conveyor (variable speed control by individual hydraulic motor). The rate is controlled to synchronize with the capacity of the conveyor belts which transport the graded pineapples to the transverse distribution belts.

**THE FRUIT PASSES** at a controlled rate from the slat conveyors to the sizing graders where the desirable fruit sizes are separated and discharged into separate conveyors.



**HYDRAULIC SYSTEM** for one of the dumping lines. The large cylinder lifts a 7½ ton bin; the smaller cylinder elevates the slat conveyor; and fluid motor drives the conveyor.




**THE 7½ TON BINS,** set into position by straddle trucks, are tilted by a hydraulic cylinder to discharge the pineapple to the in-feed conveyor. The bin is lowered by the table weight acting against cylinder.

*If you're just holding on to old hydraulic equipment because long delivery dates or cost of a new press have prevented you from considering new equipment, here's an installation which will interest you. You can probably get more production with a lot less maintenance by revamping the power system on your old equipment. Here is how a . . .*

# Power Package Gives Ne

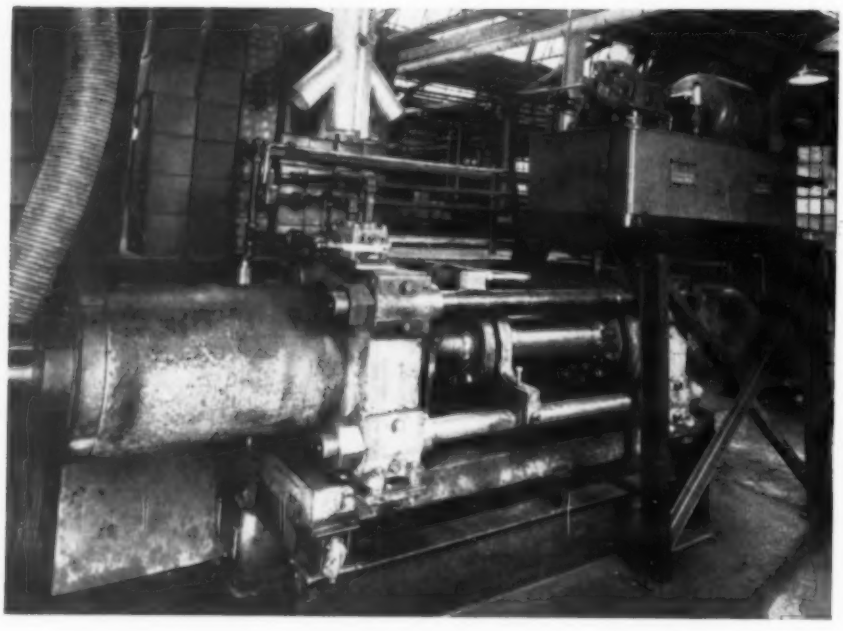


**Fig. 1. THE FRONT,** discharge, end of the plastic packing extruder. The space saving and accessibility of the elevated position of the package power unit and the shortness of pressure lines is apparent.

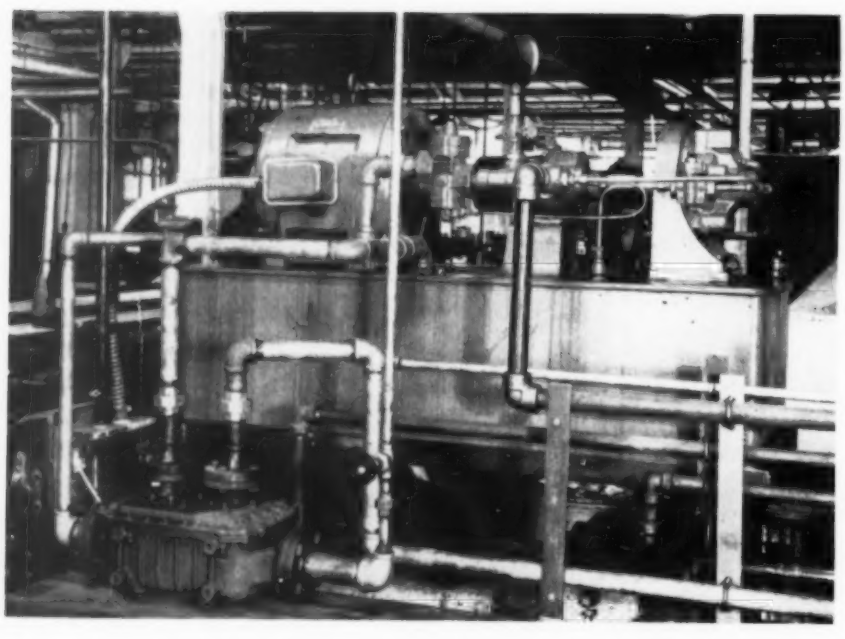


**Fig 2. THE REAR** of the motor-pump assembly showing the plate tube type cooler mounted on an intermediate level platform.

# New Life To An Old Machine

UNITED States Asbestos Division of Raybestos-Manhattan, Inc., at Manheim, Pa., has tripled production of plastic packing on an old rebuilt extrustion press, redesigned around a double pump unit, basically a semi-custom package power unit. The extruder and pump units were installed to supplement an existing 6 in x 6 in x 30 in stroke press which could not extrude some of the stock and could not meet production requirements. In addition to practically eliminating the high waste formerly accepted as unavoidable, total production per man hour has been approximately tripled.

The extrusion press had been in the shop so long that its make was unknown. The press is epuipped with a 12 inch diameter, 30 inch stroke cylinder having a rod diameter of 9 inches. The press was originally operated with water as the hydraulic fluid and was equipped with a dual pressure vertical triplex pump with a capacity of 7½ gpm at 1500 psi or 3½ gpm at 6000 psi. Since higher speeds and a maximum operating pressure of 3500 psi were desired, this pumping arrangement was no longer satisfactory.

In the process of modernization, the press was completely rebuilt. The company's own VeeFlex automatic packings were installed at all critical points, virtually eliminating packing difficulties. Heavy hydraulic pipe was used between the pumping unit and the press, primarily because tubing and fittings were not available at the time the job was installed.

## *New Hydraulic Circuit*

The new double pump unit—a 40 gpm gear pump for the low pressure and a 5 gpm radial piston pump for the high pressure, coupling connected, are driven by a 15 hp AC induction motor. These units are mounted on top of the reservoir. The reservoir is mounted on a platform above the back end of the extruder, both to conserve space and to keep the piping runs short. Another advantage is that this elevated position gives the maximum accessibility to the pumps, motor, valves and reservoir.

Simplicity of the high-low circuit is apparent from the schematic. The machine cycle is controlled by the

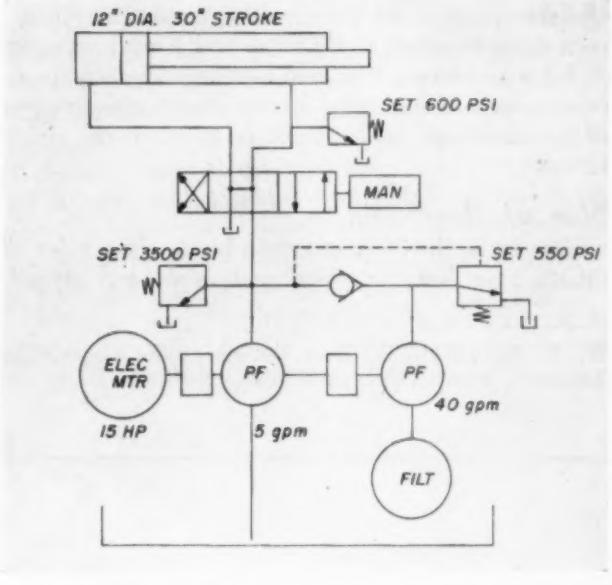



**Fig. 3. SCHEMATIC** diagram of the hydraulic circuit.

lever operated four-way open center, three position detent valve, so that the spool is held in position until changed manually. The plate tube type cooler is located in the discharge port line of the four-way valve.

The plate tube type cooler was added since the rebuilt press has been in operation. It is operated by a manually operated valve on the water supply line. To assure automatic operation a small thermostatically controlled valve has recently been added.

The unloading or by-pass valve in the low pressure line is opened by the low volume high pressure pump to discharge the low pressure pump to reservoir when the machine is feeding or is in a static position. This valve is set at 550 psi. A check valve is installed beyond the by-pass valve.

The high pressure discharge, after the low pressure pump is cut off to by-pass to tank at no pressure load,

Continued on page 92

# How To Design Hydraulic Reservoirs

**Part 2 of a series on "Good Practices in Designing and Building of Hydraulic Power Systems"**

By W. T. McCormick

OF all hydraulic components, none is more important than the reservoir. A correctly sized, baffled and constructed reservoir with properly arranged cored passages and service openings, is essential for the efficient operation of a hydraulic circuit. Conversely, reservoirs too small, badly located, difficult to connect to drain and return lines and relatively inaccessible to service, have undoubtedly delayed the normal progress of hydraulics as much, if not more, then any single factor.

## *Size of Reservoir*

How large should a reservoir be. Various rules of thumb have been proposed and used—and abused. However, if the volume of the reservoir is equal to at least three times the volumetric rating of the pump in gpm, the first basic requirement is met. The type of circuit, e.g., the actual time of working pressure divided by the total cycle time, is an important design factor. Continuous or intermittent service requirements is another. Basically, the reservoir must be large enough for the returning oil to demulsify completely, mix well with the oil in the reservoir and to dissipate a good part of the heat generated through the circuit.

A reservoir whose top face is less than 16 x 30 inches will almost always be unsuitable for centralized control; this face determines the overall width and working depth of the panel. Actually, a relatively small number of standard reservoir sizes—10, 15, 30, 45, 75 and 100 gallons—can meet the volumetric requirements of a wide range of pumps.

W. T. McCORMICK, Tool Designer, the Caterpillar Tractor Company, Peoria, Illinois.

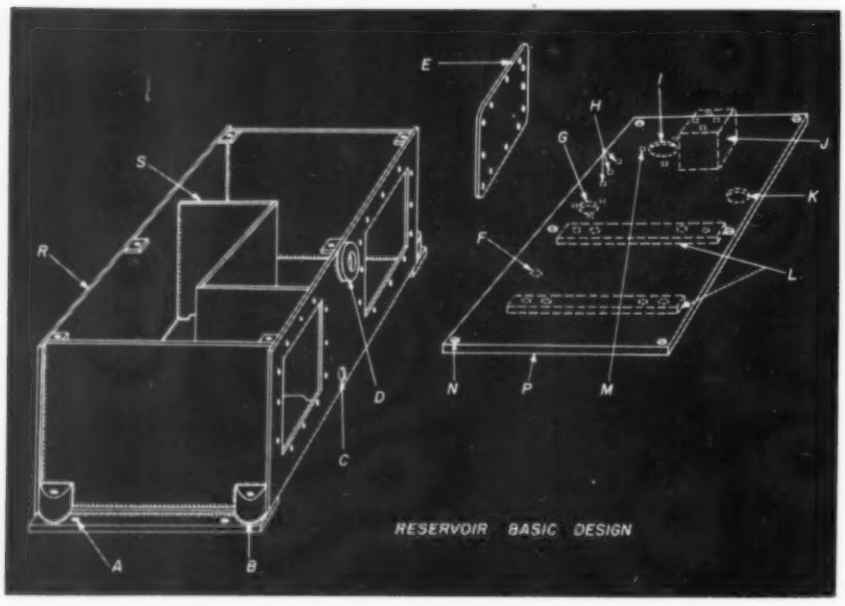



**Fig. 1. BASIC DESIGN** of a typical reservoir.

A—Anchor holes

B—Boss for leveling screws

C—Drain opening

D—Fluid level gauge

E—Covers, inspection, two required

F—Approximate location of breather

G—Approximate location of returns

H—Drains as needed

I—Intake

J—Pump riser

K—Approximate location of filler tube

L—Motor risers

M—Seal mounting holes (I and G)

N—Plate assembly holes (6) of which four corner holes are used for control panel anchorage

P—Reservoir plate

R—Reservoir body

S—Baffle

### *Construction*

The basic construction of a standard reservoir is shown in Figure 1. The reservoir may be a single unit or two piece construction, with removable top. The top should be of sufficient weight to provide adequate support for and to hold alignment of pump and motor, when these are mounted on the top plate. The top plate should have a smooth machine finish to facilitate accurate pump-motor alignment.

We try to hold misalignment to .002 total indicator movement, if possible, the amount of error being only half as much. We believe in setting this factor for the poorest pump design we use. When a rotating shaft drives another through a flexible coupling, the shafts tend to seek the same center of rotation at the point the driving thrust is transmitted. This has a tendency to impart whip or deflection in the smaller or weaker shaft. Since various pump designs have a single row of ball bearings (no tail bearings to support the end of the drive shaft), revolve in floating pump members, drive a pumping member on the pintle shaft or drive a member that thrusts against a valve plate, the best alignment possible is important, as the best of bearings will wear. As far as possible, we try to use radially balanced couplings which do not create whip due to unbalance of weight.

Baffles should be symmetrical in design so that the cover can be reversed end to end or the pump and motor arrangement reversed. For a single baffle, one resembling half a swastika does an adequate job. Multiple baffles, when used, should divide the reservoir proportionately. This also facilitates adapting the reservoir volume when desirable (Figure 2).

Two design details, innovations as far as the writer's experience is concerned, must be mentioned also. The first is that the reservoir floor or bottom is inclined toward the drain or drains. A practical rule is that the reservoir floor be inclined not more than ¼ inch or less than ⅛ inch per foot toward the drain.

The second innovation is provision for connections for an emergency fluid replacement or service unit. The latter might be a portable oil reclaiming or filtration unit.

### *Plate Openings*

The intake, breather and filler are located in the top plate. The intake opening should be of sufficient size to permit insertion and removal of the pump intake line and filter, whether a filter is used or not. An air filter is used in the reservoir breather. The capacity of the filter should permit it to pass, per unit of time, a volume of air equal to at least twice the volume of the pump.

The air filter should be protected by location, behind some heavy component, e.g., motor, or other protected place. This is particularly important for the protruding type, which is normally die cast with a sheet aluminum or other light metal cover or an assembly held together by small or lightweight screws. Being replaceable or reusable, filters are relatively fragile. In an exposed position an air filter cap may be broken off by careless handling of materials or tools or it may be used as a convenient step for operators and maintenance men. A broken air filter, obviously, leaves a wide open hole in the reservoir.

The filler should be located near the front face to facilitate servicing. The filler may be assembled from standard pipe fittings and capped. When it is necessary

### *Here's Your Checklist for Good Reservoir Construction*

1. *Volume of reservoir should be at least three times the volumetric rating of the pump*
2. *Reservoir body may be single or two piece construction (top as second piece); top plate should be heavy enough to support and hold alignment of motor-pump units*
3. *Baffles should be symmetrical and divide the reservoir proportionally*
4. *Front side is to be left unobstructed for maintenance*
5. *Intake, breather and filler tube are to be located on the top face in positions where they will be protected from damage*
6. *Fluid level and reservoir drain are to be located on the front face*
7. *Access openings on the front face shall provide access to all internal cavities.*

**"Hydraulic reservoirs should be designed, not just thrown together to hold oil"**

to fully enclose the hydraulic power unit, a filler "spout" could be extended outside the enclosure by using a single 45 degree elbow.

Before the war it was common practice to use felt to seal all reservoir penetration openings in the top face. This material, because of its tendency to become soggy and contaminated, was more or less conducive to entry of foreign matter, dirt, etc. For this reason, felt is giving way to "O" rings, which provide one of the best static seals. For this purpose, "O" rings should be comparatively thick in section, allowing for considerable compression.

Extra pipe tapped holes, which are plugged, are provided as additional drains in case it is advisable to divide returns or take care of changes in the circuit which may require draining.

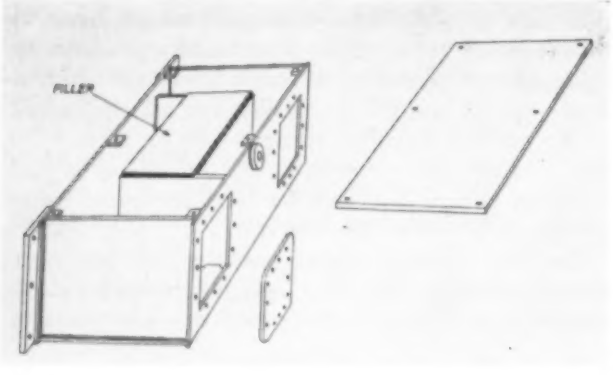



Fig. 2. A FILLER in a symmetrical design reservoir. The design has been altered for attachment to machine face.

Provisions for anchorage and leveling are, of course, a matter for the decision of the individual designer or company standards. In our design (Figures 1 and 2) we provide anchor holes in the foot plate, even if no leveling device is embodied in the design. In this case final installations are placed upon floor leveling jacks and securely anchored.

### *Front Plate Openings*

The fluid level gauge and the reservoir drain are located on the front face of the reservoir. The drain may be fitted for a hose or pipe connection, depending on the equipment used to drain the reservoir. The drain design should provide for a maximum rate of removal of fluid with a minimum of spillage.

Access doors or openings to all internal cavities of the reservoir are located on the front face. On the smaller sizes these openings are sized and located so that any part of the reservoir interior is within the reach of an average man's arm. On the larger sizes, 75 gallons and up, the entire area enclosed should be visible through the access doors or openings.

### *Cleaning the Reservoir*

New reservoirs should be sandblasted to remove scale, rust and weld flux. After all machine operations are completed, the reservoir cavity should be thoroughly washed with a hot caustic solution, rinsed in hot water and internally coated with a suitable sealing compound. The compound we use is in sprayable paint form. Developed especially by our engineering department, the compound has definite protective properties as well as sealing characteristics. Any good coating compound should give the same results.

Old or used reservoirs should be drained, the inspection plates removed and whatever residue or sludge or scale that still remains carefully removed. Even if flushing compounds are used, the reservoir is the "end of the line" for the foreign matter in the system and the same thorough cleaning given a new reservoir should be repeated.

### *Motor-Pump Units Mounted on Reservoirs*

It is a growing practice to mount the motor-pump assembly on the top face of the reservoir. It is important that the motor-pump assembly be mounted centrally from end to end and to the front side of the center line as far as possible. In a majority of installations, this arrangement provides an unobstructed front side for maintenance purposes. In addition, the electric junction box located on the motor frame should preferably open toward the front face for the same reason.

It has been our practice to locate our units immediately beside or behind the machine, whichever is permissible, as determined by space allotment from our Planning Department. Since our reservoirs are constructed of fabricated flat plate, they are relatively heavy, we rely on convection as well as radiation for cooling. We try to provide at least six inches of air space between the reservoir and the nearest machine member for this reason.

### *Operating Temperatures*

We estimate the operating temperature for a given circuit. We estimate our maximum summer temperature at 100 F. and our maximum winter temperature at 72 F. or a yearly mean of 86 F. We assume that 20 percent of the horsepower consumed by the pump is wasted in the form of heat and convert this to Btu. We figure the volume of the reservoir and use a specific heat of .4 for the oil. We compute the temperature rise from the weight of the reservoir oil. Then we subtract the heat dissipation by radiation and convection, using the approximate factor of 2 Btu per degree F. of temperature rise for each square foot of reservoir area, disregarding the base area. The difference is the approximate net heat rise. While this does not take into consideration heat gains by working components or heat gains from other sources, it does give a good working approximation.

In summarizing, the consideration given the reservoir in the design of a hydraulic circuit is time well spent. Proper design of a system reservoir is a basic requirement for the construction and operation of an efficient hydraulic circuit.

CIRCUIT HINTS

# PRESSURE SWITCH REVERSAL of Piercing Tools

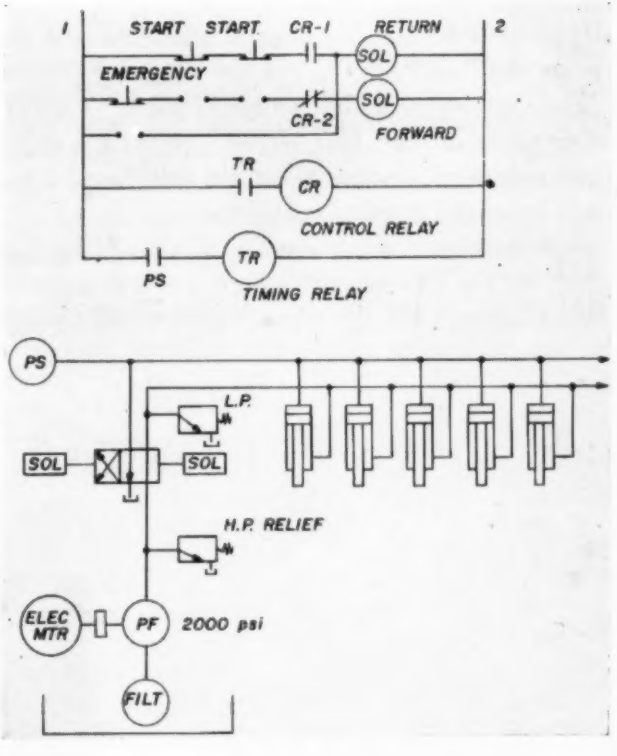
By Rupert P. Esser

ON a special press having twelve piercing cylinders, any of which can be cut off the line as required by the work piece, stroke reversal by pressure switch is more practical than timer reversal.

Using a constant delivery pump, the approach or down-travel time of the cylinders varies with the number of cylinders requiring oil power for a given set-up. If a timer reversal had been incorporated it would have necessitated either to change the setting of the timing relay every time a cylinder was added or deducted from the operation, or to set the timing period long enough to take care of the maximum number of cylinders, which would naturally result in a loss of time when operating with less than the maximum number of cylinders.

For this reason it was decided to do the reversal with the pressure switch. Previous sad experiences with pressure switches had taught us that it is quite possible that the pressure switch will cause the reversal of the four-way valve at the retraction of the cylinders before all punches have pierced through unless a timing relay was also introduced in the circuit. This is shown on the accompanying circuit.

Two start buttons hooked up in series for safety reasons will have to be depressed for energizing the forward or down coil of the 2 position four-way solenoid valve. When all punches have broken through, or even before they all have broken through, the rise in the pressure to somewhere near the maximum will cause the pressure switch to close. However this will not cause immediate reversal but it will at this time energize the timing relay. A very short period, possibly half a second later, the timing relay will close its contact and energize the main relay which in turn will energize the return or up stroke coil of the four-way valve.




If for some reason the two buttons have not been returned to the starting position, that means the operator should remove both hands and dare not tie one of the push buttons down, the machine will not return. This is an added and important safety feature. An emergency return button has been provided to immediately reverse the four-way valve if the operator

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RUPERT P. ESSER is chief engineer of TEC Engineering Corp., Logansport, Indiana.

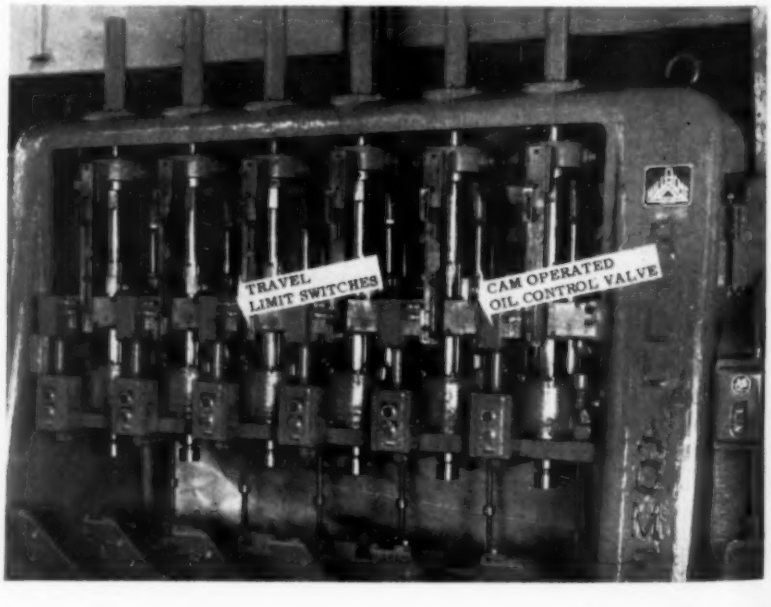
# Feed Design For Multiple Spindle Tapper

By Merle W. Lamprecht
Chief Engineer
The Hill Acme Company

*What's the best method of replacing a mechanical feed system? If you're considering a redesign of a mechanical feed system to one which will be easier to build, maintain and operate, and will offer a greater range of control here's a design which you will want to study. Engineers at The Hill Acme Company worked out this feed system for their new line of nut and coupling tapping machines.*

ON the new nut and coupling tappers being built by The Hill Acme Company, a combination air and oil system was specially designed to rapidly feed the taps to and from the work. For many years, since 1916, Hill Acme had built tappers having a mechanical feed. In those days, cams, worms and gears were really the only practical drive mechanisms. The old feed system was rugged, but it did not provide a feed which could be easily adjusted. And, because in recent years, assembly and fabrication costs have risen, a new design requiring fewer machined and fitted parts was desirable. Further, and most important, while the old machine was quite serviceable, a new design was required to improve its production efficiency.

The new design has resulted in a machine which gives an increase in the average production rate of




**THE FRONT COVER** of this six spindle nut tapper has been removed to show the operation cams and the toggle cam flow valve which gives rapid or slow spindle advance. Individual push button control has greatly reduced operator fatigue and increased production.

up to 30 percent. Operator fatigue has been greatly reduced, and the quality of work has been improved. How does a fluid feed system accomplish these production gains?

The design makes it possible to operate the machine with individual push button controls throughout its cycle. Centralized controls which require only pushbutton operation increase production efficiency while greatly reducing operator fatigue. Improved work quality is made possible by having complete control of spindle tapping pressure. This pressure and "in lead" tapping speed may be easily adjusted for the proper pitch and material.

### *Controlled Oil Flow*

Final design of the feed system is clearly shown in the accompanying pictures and schematic for a six spindle nut tapper. Advancing the spindle is accomplished by a clevis mounted 3 inch cylinder operating through a mechanical linkage. While shop air pressure is used as the power source, controlled oil flow regulates the speed and assures smooth, shockless travel.

Shop air feeds into a manifold which runs along the rear of the machine. A pressure regulator to the right of the air intake is set to charge the air reservoir under a pressure of 55 to 65 psi. This air pressure is exerted above the oil in the oil reservoir. Oil at a pressure determined by the regulator setting is carried in a manifold to the blank end of each of the feed cylinders. In each of these cylinder lines is a cam operated oil control valve seen on the front of the machine. This cam operated valve is a modification of a standard 2-way air valve which permits free flow when the roller is depressed and controlled flow when the roller is free. An adjustment screw on the front of the valve permits regulating the amount of controlled flow so that the "in lead" feed rate of the spindle is simply adjusted for different pitches.

Actuating the 3-way solenoid operated air control valve directs the air pressure to the rod end of the cylinder. This air pressure is set by the pressure regulator seen at the left of the air inlet to the manifold. The air pressure must be higher than the oil pressure to assure downward movement of the spindle when the start button is pushed.

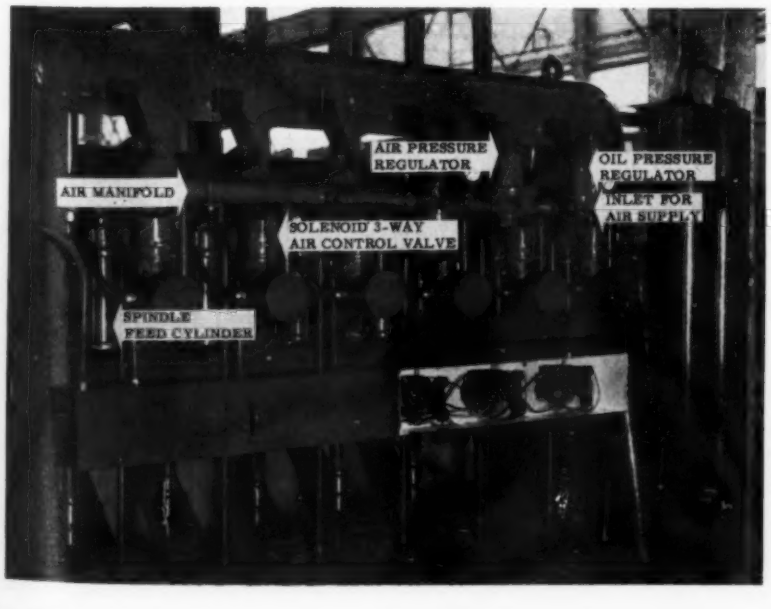
Because both air and oil are used, care must be taken to fully bleed the oil lines of any entrained air. Trapped air will cause a jerking of the spindles in the feed movement.

Several design considerations minimize trapping or entraining air in the oil. First, a long piston head is used having conventional cup packings separated by a follower plate. The plate is drilled to a hole which leads out of the piston rod to atmosphere. In this way any air which may pass the rod end packing bleeds to atmosphere rather than mix with oil on the head end. Also entrained air in oil is reduced or eliminated if there is little or no turbulence in the system. Using a long reservoir, the amount of oil which is being shuttled back and forth is very small in comparison to tank capacity; therefore, the oil picks up very little air even though the air is in direct contact with the oil in the reservoir.

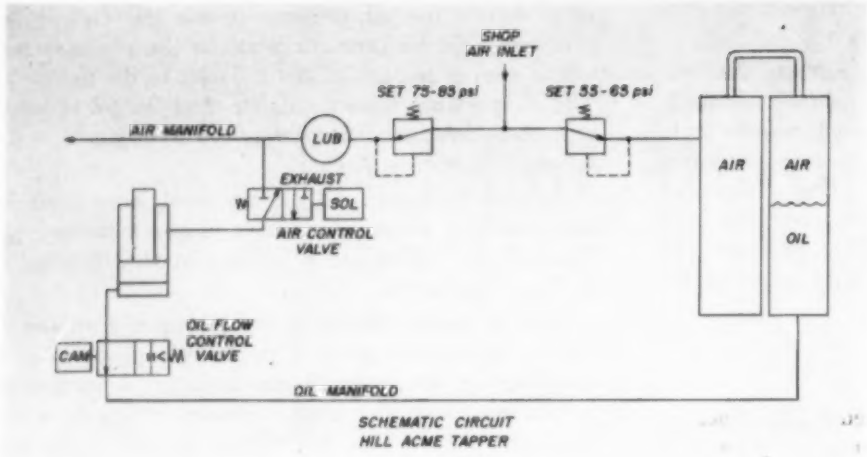
### *Mufflers Reduce Air Noise*

Operating noise is greatly reduced by the use of a small muffler connected to the exhaust port of each 3-way valve. The mufflers, seen mounted to the valves in the rear view photo of the tapper, are small baffled chambers which absorb the noise of the escaping air.

Here's the cycle of operation. Blank nuts are loaded in the inclined gravity feed chutes. Pressing the start button energizes the air valve solenoid which shifts to allow air to enter the rod end of the cylinder. This




**EACH SPINDLE FEED** is independently powered by a cylinder. Air pressure controlled by solenoid valves goes to the top of each cylinder. Oil pressure is exerted on the bottom. The oil reservoir is the tank on the right; adjacent to it is the air reservoir.



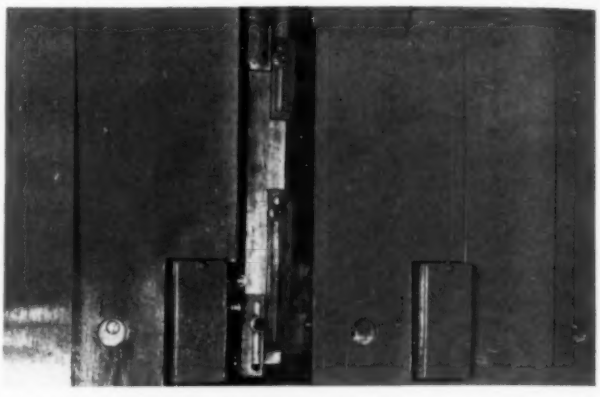

**A COMBINATION AIR** and oil circuit powers the feed cylinders. Air is used to develop the oil pressure which provides smooth adjustable speed control.

air exerts a greater force on the rod end area than the force due to oil pressure on the blank end area. The spindle rapidly drops at a speed determined by rate of oil discharged from the blank end. When the spindle advances to approximately ¼ inch before the tap enters the nut, a cam plate moves off the toggle roller on the speed control valve, and the spindle continues downward at the "in lead" speed of the tap. As the tap completes its operation, another cam plate depresses the valve roller and the spindle advance is again rapid until a limit switch is tripped to deenergize the air solenoid valve. This opens the rod end cylinder port to exhaust pressure. Oil pressure on the head end raises the spindle to its upper position.

## *Air Gives Speed at Low Cost*

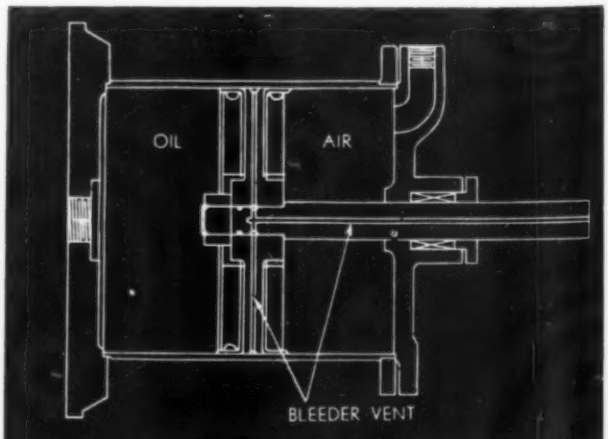
Each spindle feeds independently and the tapping operation is continuous until the tap shank is filled with tapped nuts. With the tap shank full the spindle idles in the down position because the full shank will not permit the spindle to advance far enough to cause tripping of the return limit switch. The operator presses the stop button and the spindle rises and stops in the up position where the tap is quickly removed and the nuts unloaded into a discharge chute located between spindles at the rear of the machine.

The simplicity of this feed design makes possible a compact system which only requires suitable electrical current and 90 psi air pressure. Use of a combination air and oil system has many advantages over a feed which is fully powered by air or oil alone. If only air were used to feed the spindles, uniform control would be difficult to maintain because of air compressibility. A full oil system would not be practical from a cost standpoint and is of course quite unnecessary because only low operating pressures are required. The feed system designed for the Hill Acme tapper has the advantages of speed and low cost which air operation offers and the complete control which oil power makes possible.



**CLOSEUP OF THE FEED** control cams. The cams on the right can be adjusted to give rapid travel or feed. When the valve roller is depressed, the spindle feeds rapidly. Small cam plates on the left, trip limit switches to automatically control reversal of the spindle.

**CYLINDER DESIGN** prevents air from mixing with oil. A hole in the piston follower plate bleeds any bypassed air to atmosphere through the hole in the piston rod.



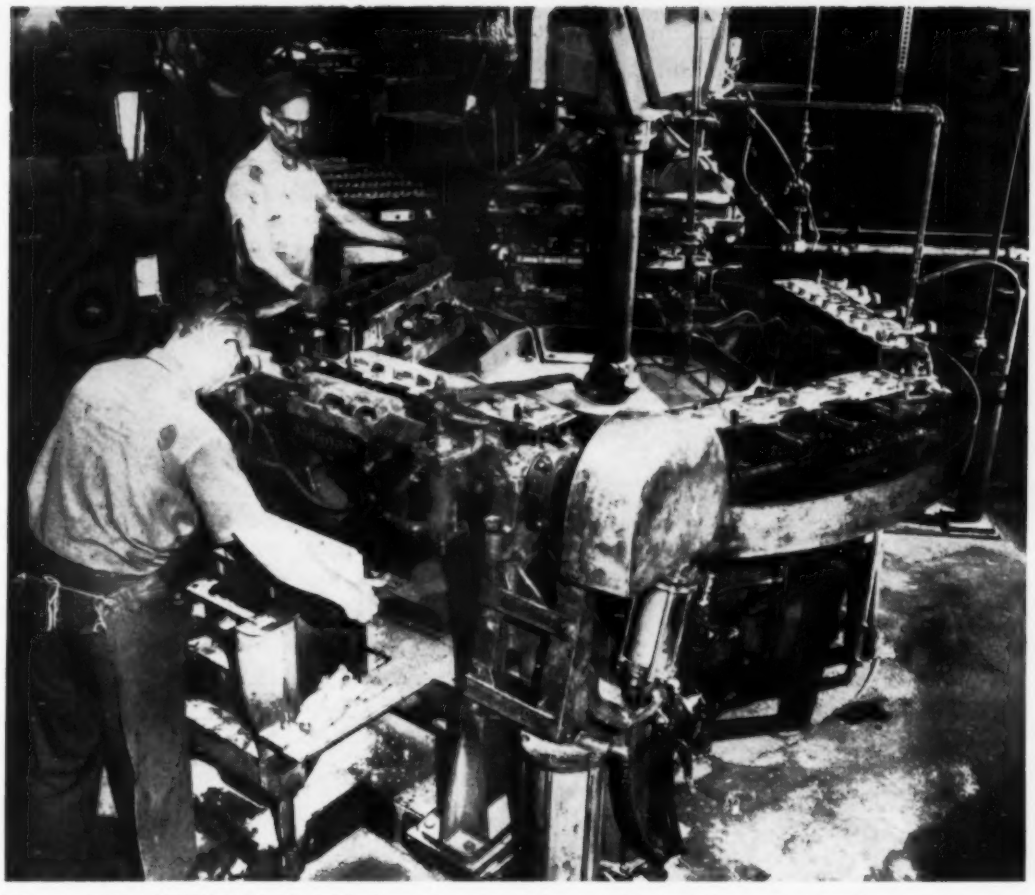


**Fig. 1. THE AUTOMATIC CORE** making machine in the foundry of a leading automotive manufacturer. The operator at station No. 3 (foreground) is removing the core from the drier plate; the turnover cylinders have just returned the empty core box to the turnable. Operator at station No. 2 is placing a drier plate over a core box. This machine, with auxiliary equipment added by the foundry, turns out 375 or more cores per hour.

# Core Making Machine Steps Up Production 600 Percent

By L. C. Cole

A COMPLETELY automatic, pneumatically operated and electrically controlled core making machine, now in production at The Osborn Manufacturing Company, Cleveland, offers a new standard of uniform high quality cores at a higher rate than previously possible. One machine, in use for a year in the foundry of a leading automotive manufacturer, is turning out engine block jacket cores at a rate six times that of a trained coremaker. The average rate of gain in a number of foundries, automotive and others, has been 600 percent.

The machine is the first to combine the three main jobs of core making, (a) blowing the core, (b) handling of core boxes to and from the core blower, and (c) the rollover and core drawing, in one piece of fully automatic equipment. The three main mechanisms, which will be described in turn, are coordinated and sequenced by a cam type multiple circuit electric timer, the timer opening and closing preset contacts to operate solenoid air valves, which in turn, control cylinders

L. C. COLE, Chief Engineer, Machine Division, The Osborn Manufacturing Co., Cleveland, Ohio.

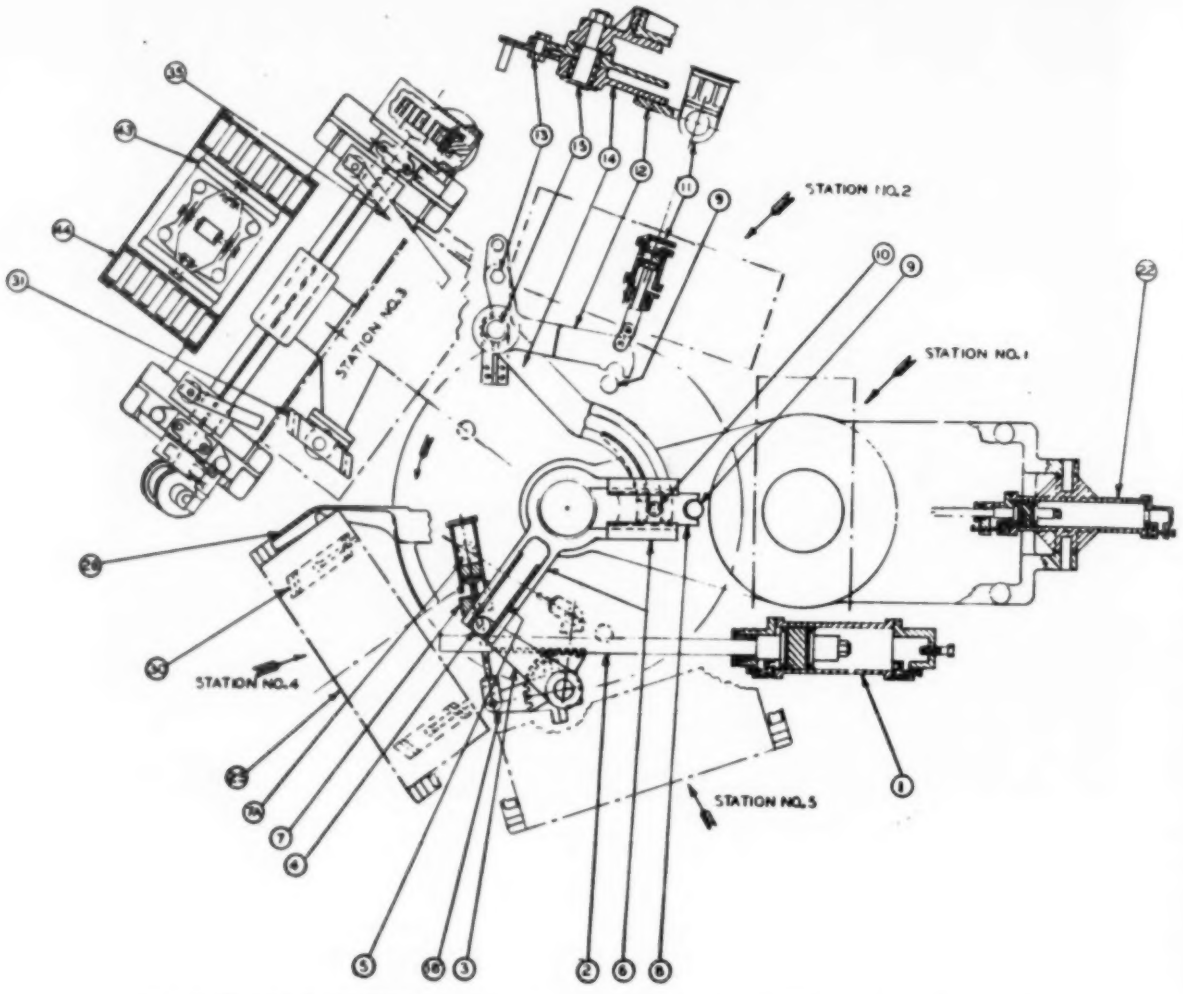



**Fig. 2. THIS PLAN VIEW** shows the arrangement of pneumatic and mechanical components of the index mechanism. Some core blowing and turnover station units are also shown.

1 Index cylinder
2 Rack
3 Pinion and arm
4 Roller
5 Slot
6 Turnable drive arm
7 Cushion cylinder
8 Tongue or slide
9 Turntable pins
10 Tongue or slide pin
11 Lock cylinder
12 Lock arm
13 Lock Arm bolt
14 Slotted arm
15 Lock Arm pivot
18 Cushion cylinder piston arm
22 Sand carriage operating cylinder
25 Core box platens
26 Fork holding arms or cradle
30 Rotating cleats
31 Reverse lips
35 Clamp arms
43 Levelers
44 Runout rollers

which power the various operations.

In one cycle of the core making machine, the turntable indexes one station counterclockwise, the sand reservoir is filled, the core box assembly raised and clamped against a seal ring in the head frame of the core blower, the core blown. Simultaneously, with the operation at the core ramming station (station No. 1), the filled core which was indexed to station No. 2, has a drier plate placed over the core, the rollover and core drawing operations are being performed at station No. 3 and the necessary makeup operations are being done at stations No. 4 and 5. The latter operations include cleaning the box, applying a parting compound or agent, insertion of loose pieces or vents and, when necessary, the insertion of support wires.

## *Core Blowing*

One of the distinctive features of the Osborn core blower is that it is designed to permit the turntable to rotate around one vertical strain rod. The strain rod is rigidly attached to the base and to the head frame of the core blower. A pair of strain rods on the outside

of the machine are spaced to allow a slide carriage within the head frame to move between them. This sand carriage operating cylinder, a double acting air cylinder, shuttles the carriage from the out or blow position to the in or fill position. The shuttle movement, to conserve overall circuit time, is simultaneous with the indexing operation.

Sand from the top hopper is fed by gravity into the open top of the sand reservoir and a cavity in the carriage.

When the carriage operating cylinder has extended on its power stroke, the carriage and reservoir are in the blowing position and the turntable is locked, the three-way valve supplies air to the head end of the vertical clamp cylinder. A clamp table is mounted on the top of this piston. The piston and table rise, pick up a platen and the core box assembly and lift them against seal ring in the head frame of the core blower. The rate of rise is controlled by a speed control valve. After contact with the seal ring, the pressure rises rapidly to hold against the blowing pressure developed in the core box.

Next, the top mounted blow valve is opened by the release of pressure on the top side of its diaphragm and air pressure drives sand through openings in the blow plate into the core box. The core is blown.

When the core box is filled, pressure on the upper side of the diaphragm closes the blow valve. The reservoir exhaust valve, opened by the release of pressure on the outer side of the diaphragm, permits air in the sand reservoir to escape through screened openings in the exhaust valve. With this release of air pressure, the vertical clamp three-way valve reverses and the core box, platen and piston lowers. The core box is picked off by cradle arms, the clamp piston descends to the bottom of its stroke. The core blower is then ready for the turntable to deliver the next empty core box to station No. 1.

### *Turntable and its Operation*

The second major core making operation or function, the handling of core boxes, empty to and full away from the core blowing station, is performed by a five-station turntable, interlocked with the core blower and indexed by an ingenious arrangement of air cylinders.

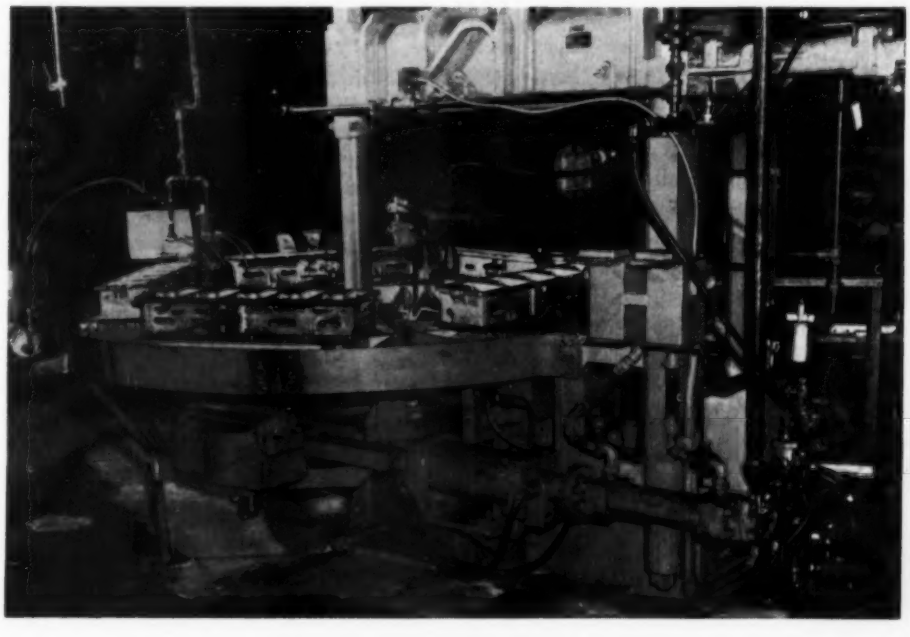
Essentially, the indexing operation is performed by means of a double acting air cylinder (1) which drives a rack (2) attached to the outer piston end. The rack rotates a pinion and arm (3). A roller at the end of the arm (4), permanently engaged in a slot (5) and drives the turntable arm (6) counter-clockwise, in a Geneva type movement, rotating the turntable 72 degrees. The drive arm can turn with or independent of the turntable.

To steady and control the motion of the pinion arm (3), an oil cushion cylinder (7) which rotates about a vertical axis is used. During the first half of the pinion arm movement, the cushion cylinder piston is driven back through arm (18), keyed to the same shaft as arm 3. During the second half of the stroke, oil in the front end of the cushion cylinder is restricted as it escapes, acting as a brake on the swing of the pinion arm (3), controlling the deceleration of the movement of the turntable.

This same movement involves the return or exhaust stroke of the index cylinder. This is the only oil pressure device in the machine, all other power being pneumatic.

The front member of the drive arm (6) has a tongue or slide (8), notched at the outer end to engage pins (9) on the turntable. There is such a pin at each lock-

**Fig. 3. THE INDEX CYLINDER** with its oil cushion, the sand carriage operating cylinder (upper right), sand reservoir with exhaust valve (side of reservoir) and auxiliary equipment for cleaning and applying parting compounds, are shown.



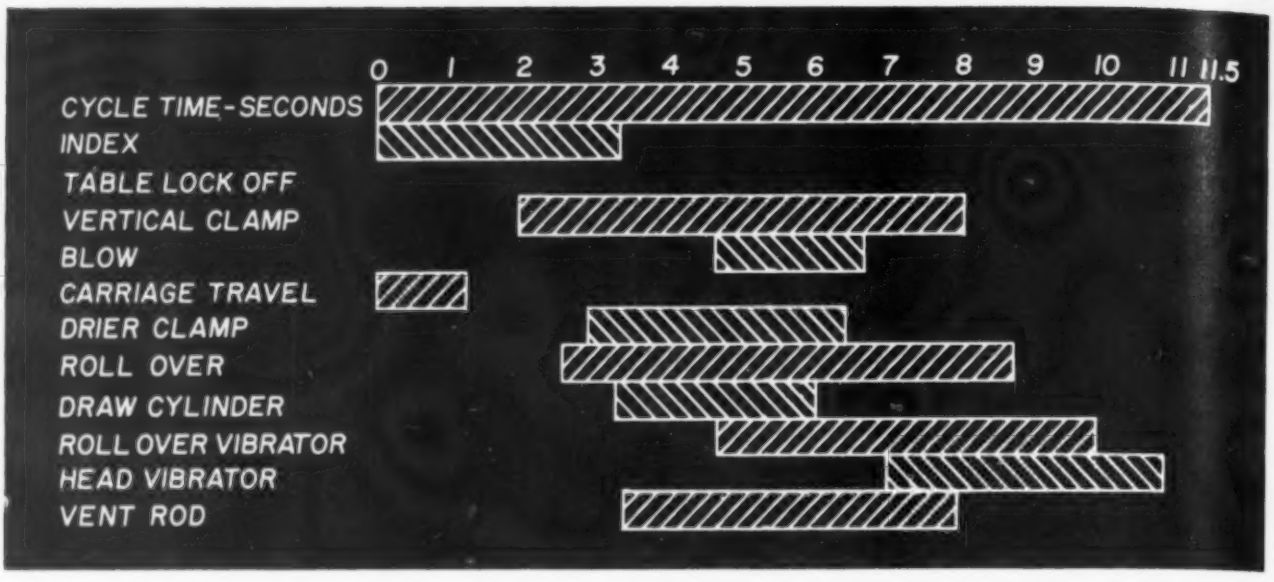



**Fig. 4. ANALYSIS of operating time of each of the machine operations.**

ing position on the turntable. The slide arrangement allows engagement during the power stroke of the indexing cylinder and disengagement during the return stroke.

The lock cylinder (11) is retracted when the index cylinder piston is extended (end of its power stroke, see Fig. 2). The lock cylinder piston rod is connected through links to lock arm (12). When the index cylinder exhausts, tongue (8) carries pin (9) and turntable to station No. 2. As the turntable comes to a stop, the piston of lock cylinder (11) moves forward, engages the notch in lock arm (12) in the turntable pin (9), locking the table. Drive arm (6), by the automatic retraction of tongue 8, is disengaged from turntable pin (at station No. 2) and returns to its original position (at station No. 1).

### *Rollover and Core Drawing*

We have described the core blowing and the indexing operations. At station No. 2, where the last indexing movement has taken the core just blown, a drier plate is manually placed over the core box. When the next core is blown, the original core is indexed to station No. 3.

At station No. 3, clamping, rollover and core drawing are accomplished, all pneumatically. Two double acting clamp cylinders of special design, are mounted between the columns that form the frame of the rollover station. The clamping cylinders on their power stroke both extend and rotate their pistons, the ends of which are fitted with clamp arms (35). A pin in the bottom of the piston housing engages in a slot in the piston; the center section of the slot curves, causing the piston to rotate on its vertical axis. The piston then finishes its stroke in a vertical movement.

The rollover cylinder, also double acting, has a rack attached to its piston end; the rack engages in a pinion keyed to an extension of the rollover shaft. On the power stroke, the piston rotates the shaft 180 degrees. This lifts the platen, corebox and drier plate off the turntable and swings them into an inverted position over the draw table.

At this point the timer cuts in the limit switch which actuates the solenoid valves controlling the draw cylinders. The two draw cylinders are mounted side by side under the draw table. Their common draw head carries leveler bars which permit leveling when the core box assembly is not parallel to the draw head. The draw head and leveling bars, rise between the runout rollers (44) and contact the drier plate.

The vibrators are run, loose pieces removed, the clamping cylinders reversed and the drier plate clamp arms swing away. The drier plate and core lower until they rest on the runout rollers. When the core is free of the box, the rollover cylinder exhausts, swinging the empty core box back to the turntable. Platen clamps are released by exhausting the platen clamp pistons, allowing the platen to rest in the cradle arms.

A cushion cylinder, to which line pressure is applied at all times, acts as a snubber for both ends of the rollover action.

Stations 4 and 5, as noted previously, are makeup stations. Although the basic machine as described has no auxiliary equipment for the operations performed, several of the production users of this machine have devised and installed automatic cleaning, parting compound application and other equipment, most of it air operated.

The basic time cycle of the core making machine is approximately 10 seconds. Several production users have averaged 375 cores per hour.

### *Control Circuit*

The cam plate type electric timer controls the sequence of operation of solenoid valves to control cylinders which perform work movements, provides safety interlocks and very simple operation by three push buttons. Once the cycle for a given core is determined and the time and sequence has been set on

Concluded on page 113

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# Airline Experience With HYDRAULIC FLUIDS

ROBERT R. STARK, of Eastern Airlines, presided at the two day session.

AT the recent Transport Aircraft Hydraulic Conference, sponsored by Vickers Incorporated and held at the Sheraton Hotel, Detroit, on December 4 and 5, practical operational experience with hydraulic fluids, particularly nonflammable hydraulic fluids, was discussed by representatives of airlines and major suppliers. Other major items on the agenda were hydraulic system plumbing, aircraft hydraulic hose, fixed and variable displacement pumps, hydraulic motors and accumulators.

Robert R. Stark, assistant to the vice president, engineering at Eastern Airlines, presided as chairman for the two day session. Ninety-two representatives of leading airlines, including six foreign lines, plane manufacturers, the Services, major suppliers, including producers and suppliers of hydraulic fluids attended and took active part in the discussions.

Here are the highlights of the discussion on hydraulic fluids.

The chairman asked T. E. Ellison of United Airlines to summarize their experience with Skydrol DC6-B hydraulic systems with special emphasis on: (a) pump life; (b) accumulator diaphragms, hoses, seals; (c) hydraulic components; (d) leakage as related to fluid cost; (e) special maintenance or operating problems due to the use of this fluid, i.e., duplicate ground equipment, spare fluid on plane, etc.

**Skydrol on DC6-B Hydraulic Systems** Mr. Ellison stated that, with three years experience with Skydrol in superchargers, average pump life of 700-800 hours has been built up to approval for 2000 hours. Engine pumps have accumulated 6000 to 7000 hours with only nominal trouble, now corrected. The only difficulty has been with seals in sealing. Several "O" ring compounds have been used together with Teflon backup rings. A few noise dampner and main accumulators have failed, possibly due to incorrect diaphragms for Skydrol. Total leakage and operating cost figures cannot be determined to date since no DC6-B has been overhauled since the fluid conversion. The supercharger leakage has been negligible. The duplication of equipment has been a problem; a universal seal (skydrol and 366) would be very desirable. Skydrol cost figures are hard to compute solely on fluid cost per gallon, especially since it is recoverable through filtering.

A question asked by the chairman developed the

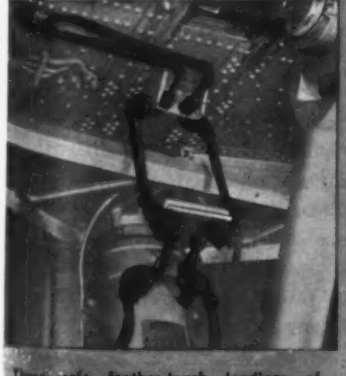
# WHEN A CONNIE FLEXES ITS LEG MUSCLES

# ...AND A NEPTUNE SPREADS ITS WINGS

## *Lockheed Engineering Turns to Chiksan to Turn the Trick*

Tested according to military specification MIL-J-5513 (AN-J-10) Chiksan Aero-Hydraulic Swivel Joints were proved more than adequate for use in Aircraft Hydraulic Systems. Above, they are shown as installed in the landing gear of the U. S. Navy's newest Neptune anti-submarine patrol bomber.

Chiksan Ball Bearing Swivel Joints have a part in bringing planes to a stop. Here, too, the liquid of hydraulic systems must flow in uninterrupted stream. Chiksan surpasses all standards set down for both civilian and military requirements—serves in braking mechanisms of Super Constellations, Neptunes and many other planes.



These safe feather-touch landings of Lockheed's new Super Constellation can be partly accounted for by the smooth, sure operation of the well-engineered hydraulic system using Chiksan Ball Bearing Swivel Joints.

THE SUPER CONSTELLATION, newest in Lockheed's fleet of transports, and the Navy's newest Neptune, tough-taloned bird of prey, are both evidence that we can "Look to Lockheed for Leadership". Both rely upon Chiksan Ball Bearing Swivel Joints to turn corners in their hydraulic systems — to flex their metal joints.

Chiksan takes such tough assignments in its stride. For Chiksan Hydraulic Joints are made for jobs where precision is the rule. Although used in 1, 2, and 3,000 psi systems these joints are tested by Chiksan's Research and Development Department in the presence of bitter cold and searing heat—under pressures as high as 10,000 psi and under the relentless driving force of continual use.

Whether the job is to keep planes flying or industry's life-blood flowing—to hasten manufacturing process and expedite transportation—to feed the veins of industry and speed the course of science and invention, there you will find Chiksan applications — Ball Bearing Swivel Joints tooled to exacting tolerances, flexing the muscles of Progress —adding sinew and flexibility to the flow of gas, liquid and modern living.

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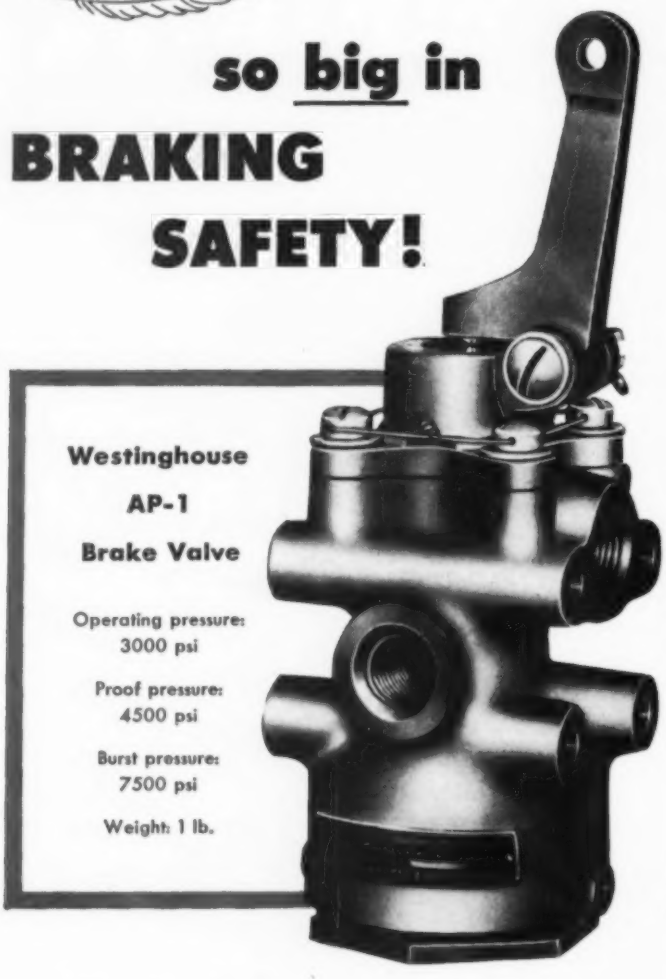


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The Westinghouse AP-1 Brake Valve permits application of a regulated pressure . . . as compared with dumping full braking pressure by other means. Used as an emergency brake, it minimizes the hazards of overbraking with the attendant risks of tire skid, ground looping, and tire blow-out.

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answer that both micronic and Fullers earth type filters were used and that approximately 4500-5000 hours service was obtained with the fluid.

The chairman asked about the personnel hazards, toxicity, etc. of Skydrol.

Mr. Ellison pointed out that ground-handling crews had been alerted and that no accidents or injuries due to the use of the fluid had been reported. He reported an enthusiastic field representative who demonstrated the safety of the fluid by swallowing a spoonful.

The chairman called on J. S. Stoker of Douglas Aircraft Company for comments.

**Experience with Seals** Mr. Stoker reported that spiral Teflon backups were very helpful in curing some of the leakage problems and that service life of the butyl seal in Skydrol was quite comparable with buna in 366 fluid. R. C. McGuire, American Airlines asked if United Airlines expected to convert the standard DC6's to Skydrol and butyl seals. Mr. Ellison expressed the view that such a conversion was a tremendous job, citing the conversion of one C-54 main system as a test, since every unit had to be re-worked by replacing the standard seals with Skydrol resistant seals. More experience is deemed essential before further conversion is decided upon, since other nonflammable fluids are being studied.

S. L. Higginbottom of Trans World Airlines asked if there was any problem in the inadvertent mixing of standard and Skydrol fluids.

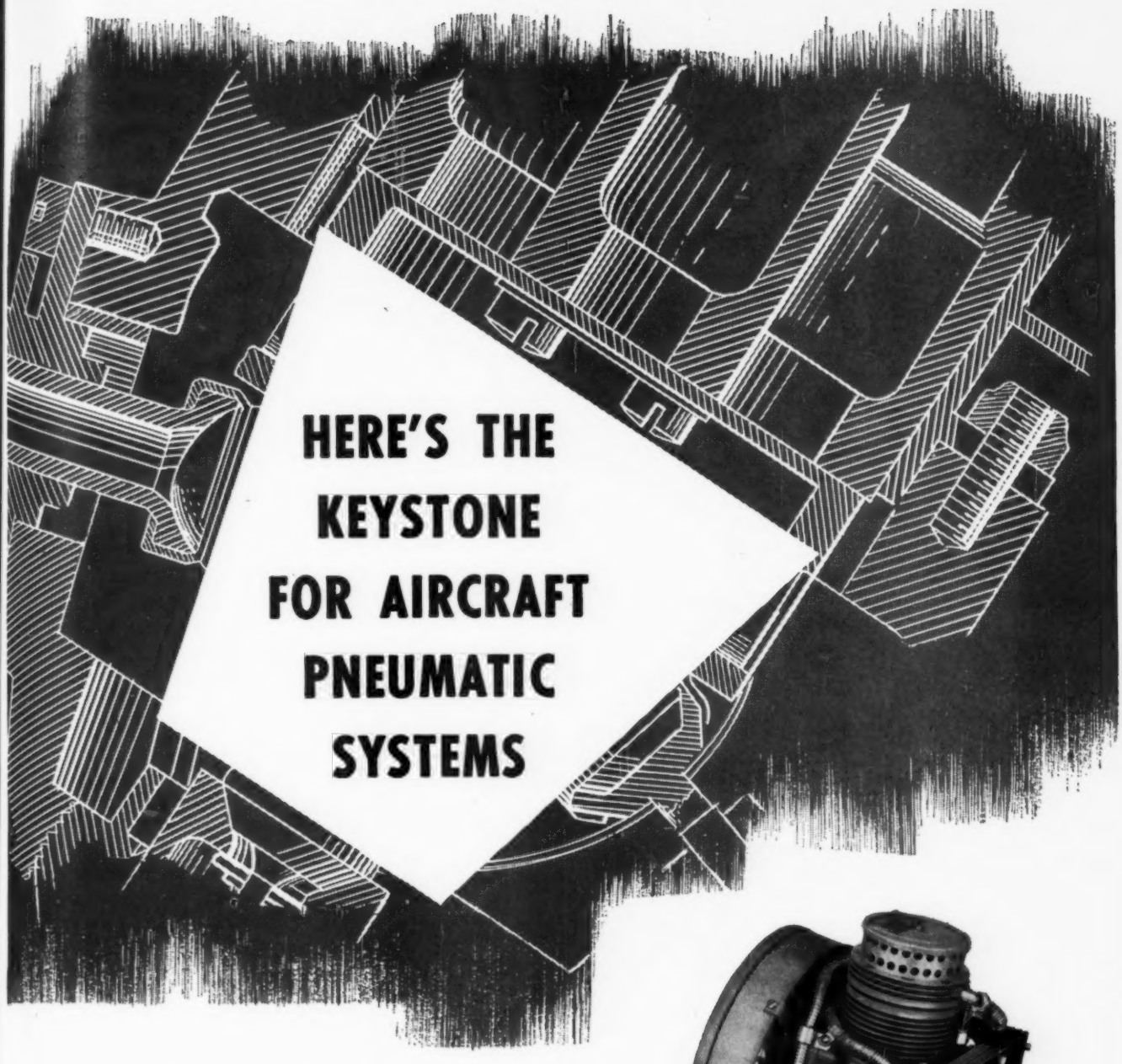
Mr. Ellison stated that, with most of their experience with superchargers, such mixing created a gum or gelatin mass, necessitating a system flushing. He expressed the view that 10 percent contamination by standard fluid can be tolerated.

**The Paint Removal Problem** W. E. Spearman of American Airlines stated that the Skydrol had taken all paint, decorative and otherwise, as well as the zinc chromate off practically everything associated with the ground equipment. In addition, some seals not directly concerned with the system, e.g., the seal for the access door to the supercharger was disintegrated. He asked United for their solution.

Mr. Ellison cited cases in which door seals had swelled, often causing the doors to spring open with some force when mechanics unlatched them. New door seals are now undergoing test. J. S. Stoker of Douglas suggested the use of duPont baked enamel on ground equipment which they have found satisfactory. He mentioned two new paints, now under test, which were also resistant.

The chairman then called on Walter V. Scholz of the R. M. Hollingshead Corporation to report on the status of their nonflammable fluid H2.

**Service Record of H2 Fluid** Mr. Scholz mentioned that H2 has been in use for approximately two years on Naval aircraft and that no major complaints of any sort have been received. He told of a service test in progress on a Transocean Airlines airplane, a DC4, which has approximately 1100 service hours to date. He relayed their report that the only trouble developed was with



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excessive swelling of a cup type leather seal in their Sperry auto-pilot servo unit. He stated that, aside from nonflammability, the major advantage of H2 was that no seals had to be changed; cutting down the changeover time and the man hours and material cost. He cited, as an example, the changeover in the Transocean airplane, where it was necessary only to flush out the 366 fluid with H2, then install H2, changing only the reservoir filter.

Mr. Scholz stated that H2 has a softening effect on paint, if left on for more than three or four hours. If washed off promptly with water, there is no effect on the paint. He recommended for areas subject to constant leakage, protection with ANL-37 type lacquer.

R. B. Ault of Eastern Airlines asked if any trouble had been experienced with leather backup rings.

Mr. Scholz answered that no such difficulty had been experienced with Naval aircraft, but admitting that airline type service is quite different from the military and that his company would obtain service tests with additional airline aircraft. He expressed the opinion that the problem of back-up rings would not be a serious one, pointing out that the cup type seal in the old Sperry auto-pilot happened to be particularly susceptible to seizure due to swelling.

R. C. McGuire of American Airlines brought up a point discussed in some detail at the November SAE A-6 meeting at Washington. This was that leather manufacturers had pointed out that leather would tend to disintegrate due to the effect of the water in the fluid on the fatty oils in the leather. He made the point that, if this develops, the problem is one of either changing leather for leather seals or leather for a compounded seal, eventually ending up with the same number of man hours to make a conversion.

R. B. Ault of Eastern Airlines wanted to know the temperature operating ranges of H2 and the permissible contamination with the standard 366 fluid.

Mr. Scholz, in answer, replied that up to 10 percent of contamination can be tolerated, as required by the specification, but that the system will operate better if the contamination is less. Contamination of less than 5 percent is easily held if the flushing is done properly. The operating limits by specification are −60 F to 160 F.

The chairman called on the Navy representatives for a report on their operating and maintenance experience with H2, with special emphasis on paint, seals, etc.

**Navy Experience with H2 Fluid**

F. P. Somers, BuAer, reported that the main recent difficulty has been with accumulator diaphragms, particularly the new buna type made in 1949 and 1950. Earlier tests had indicated that diaphragms should last much longer than with 366, e.g., 9 of the first converted F4U airplanes operated for two years, accumulating over 400 hours of operation with no diaphragm failures. It seems that H2 can be used with any type rubber—butyl, buna, neoprene, natural rubber. "We have had no reports of adverse H2 effect on hoses or wiring—some corrosion troubles seem to be peculiar to a specific type airplane. We have operated the new fluid in a test set-up at 220 F for 100 hours without any trouble. We are going to a vinyl type paint, which is entirely unaffected by the fluid."

Lt. I. E. Morgan, BuAer, supplementing Mr. Somers' report, stated that 1650 Naval airplanes are now operating with H2. He reported that squadrons returning from Korea had cited very good experience with H2 with better service and less leakage than the regular oil.

**Air Force Investigation of Nonflammable Fluids**

Lt. L. D. Christensen, Wright Air Development Center, reported on the status of their investigation on nonflammable fluids. While no one fluid yet meets MIL-F-7100, tests with silicone or silicate fluids with snuffer additives and halogenated type compounds are being made. One of the latter, containing fluorine and chlorine, is under test in a system mock-up. Tests of a silicate fluid with a snuffer additive, a silicone fluid with snuffer and synthetic diester blends are also scheduled. As far as possible, attempts are made to avoid fluids that will not work with present rubber packings, a problem with halogenated compounds and phosphate type fluids, which give excessive swell, up

**REPRESENTATIVES** of Airlines, the Services, and major suppliers of hydraulic components and fluids met in Detroit for the Transport Aircraft Hydraulic Conference.

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to 200 percent for the present packing.

H. J. Falk and Dr. T. W. Langer of Linde Air Products reported briefly on the work being done by this company on water base type nonflammable hydraulic fluids. Developments to date have been encouraging.

**Vickers Experience with nonflammable fluids on Piston Pumps**

In answering the agenda question as to Vickers' experience with Skydrol and H2 fluids used with piston (3911) pumps, James Robinson, chief engineer, Vickers, reported tests conducted with Skydrol, under constant load conditions only. Substantially the same experience was obtained as United Airlines, results revealing no reason for anticipating trouble. Tests are still under way with H2 fluid, tests being conducted under special cycling conditions to simulate actual operating conditions in a specific application.

Mr. Robinson, answering the next agenda question as to whether Vickers had tested nonflammable fluids in power transmission systems, stated that such tests had been made with H2 in relation to the requirements for 400 cycle alternator drives and that requirements appear to be met. He pointed out however, that flight tests are still to be made.

Mr. Robinson also answered the next agenda question: "Water base nonflammable fluids retain air longer than mineral oils. Assuming normal bleeding techniques, what will be the effect of small amounts of entrained air on performance of regulators, pumps, relief valves, etc?" He stated that tests have not disclosed any trouble that might be attributed to air retention.

Mr. Scholz and Mr. Falk confirmed Mr. Robinson's experience. Mr. Stoker pointed out that entrained air will slow application time, especially on braking and wing flap operation.

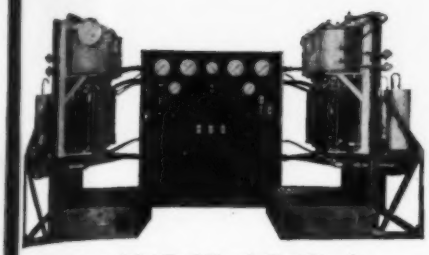
The chairman asked if reservoir design might not eliminate entrained air. Mr. Stoker expressed the view that reservoir design would help but not cure the problem. Conrad Cooke of Glenn L. Martin Company pointed out that the volume of fluid required might mean much larger reservoirs, if the new fluids retain more air. He asked if specific data was available on the rate at which various fluids dissolve or release air under various conditions.

Mr. Somers of BuAer, in answer, stated that they had not found it necessary to change any reservoir in any airplane to get elimination of air.

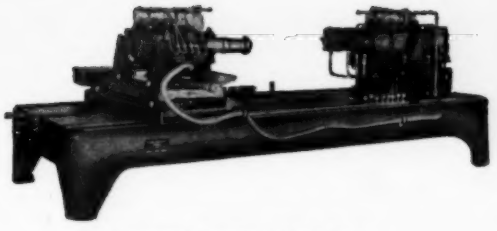
**Operating Temperatures of Hydraulic System Fluid**

"Has any transport operator measured the operating temperature of hydraulic system fluid in DC4, DC6 or Convair aircraft?" Richard Parsons of Convair reported a measured temperature in their cabin supercharger drive systems, which ran about 90 C, but that they were working to lower this to 75 C. Mr. Stoker of Douglas reported a temperature of 175 F in the cabin supercharger system; normal operating temperatures in the main systems of DC4 and DC6, with the system bypass open is 120 F.

"Is it possible for the failure of engine driven pump seals to allow nonflammable fluids to contaminate the engine oil?" Mr. Robinson reported that Vickers had received no complaints about engine oil contamination; that he believed the overboard drain would



*Universal Jet Fuel Nozzle Test Stand*



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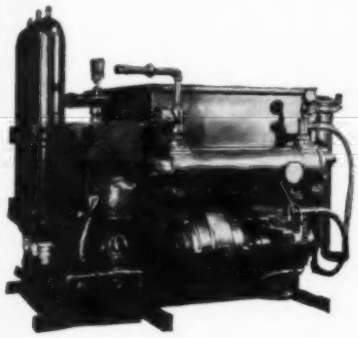
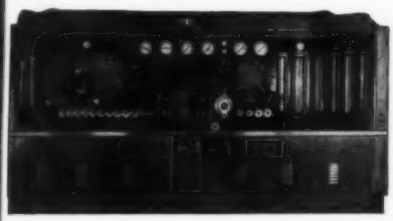
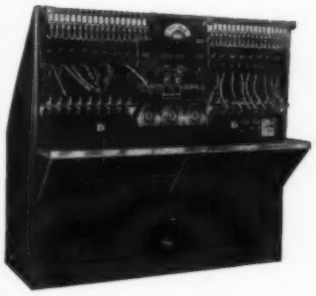


*Rock Crusher Hydraulic Power Pack*



*Jet Engine Lube Pump Test Stand*



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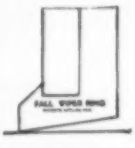

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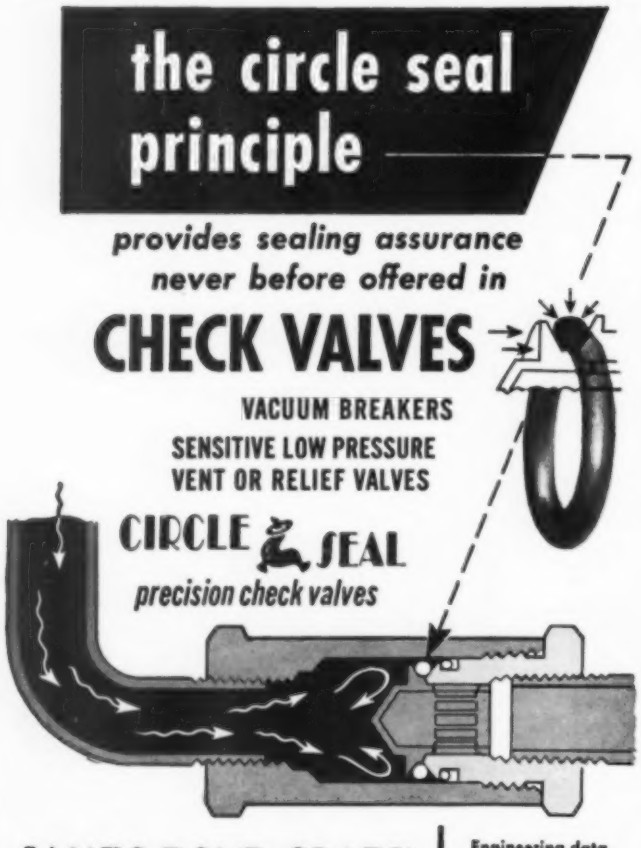

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take care of nominal pump leakage, in spite of seal failures. He stated that with fluids other than petroleum base, it was possible that the fluid would be in contact with the engine seal in the event of pump seal failure ant this might cause the latter to fail due to the chemical action of the synthetic fluid.

Mr. McGuire of American Airlines asked if anyone oil was contaminated with H2 or Skydrol. H. S. could tell him just what would happen if the engine Litzsinger of Monsanto Chemical Company, in reply expressed the opinion that Skydrol in the engine lubricant probably would make the engine run a bit better, since Skydrol is made from the same class of materials used as E. P. additives for engine lubricating oils. Mr. Sommers of BuAer expressed the view that the H2 water would boil off but that the residue—suitable for protection to 600 F—might cause some heating up.

**A Seal for nonflammable and conventional fluids?** "Is it not possible that a seal can be made that will be resistant to both Skydrol and conventional hydraulic fluids?"

This question was answered by Mr. Litzsinger who believes that such a packing can be developed. He cited work in the Monsanto research laboratories and a compound recently developed by the Phillips Petroleum Company. This company also is using Parko 805, which exhibits good compression set properties as well as excellent general physical properties.

Mr. Somers remarked that this was not a problem with the Navy since H2 will work with any packing, Teflon, buna, butyl, neoprene, anything you want to put in the system other than rope.

**Hydraulic Leak Detector Dyes** "Which airlines have used hydraulic leak detector dyes, such as Trace "O"? What do the oil companies think of this product?" W. N. Smith of Pan American Airways remarked that they had used it in the Connie supercharger to detect leaks in the units vs engine oil leaks and that it had been very successful. There were no comments from representatives of the oil companies.

"Does any operator have what they consider to be a successful method for monitoring the retorqueing of leaking hydraulic fittings in the field?"

Mr. Spearman considered leaks as probably the primary difficulty with hydraulic systems; repetitive leaks of the same fitting has been one of the troubles. Repetitive retorqueing seemed to aggravate, not fix, leaks. Mr. J. S. Hall of Eastern Airlines remarked that they had the same experience, that lines were tightened until a flare or fitting leak resulted. Mr. McGuire suggested that the elastic stop nut manufacturers might put a fibre insert or a nylon insert into a "B" nut fitting to facilitate a tight assembly.

The chairman, commenting for his company, Eastern Airlines, stated that they had developed the practice of installing short sections of Aeroquip hose or Everdur tubing at points which are frequently disconnected. He reported greater Everdur resistance to flare cracking.

Mr. Cooke of Martin suggested that a faulty flare might be a common cause for repetitive leaks and cited that a faulty presetting of the fitting ferule in

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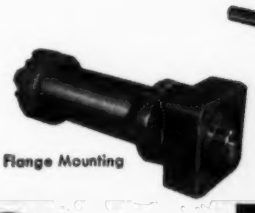

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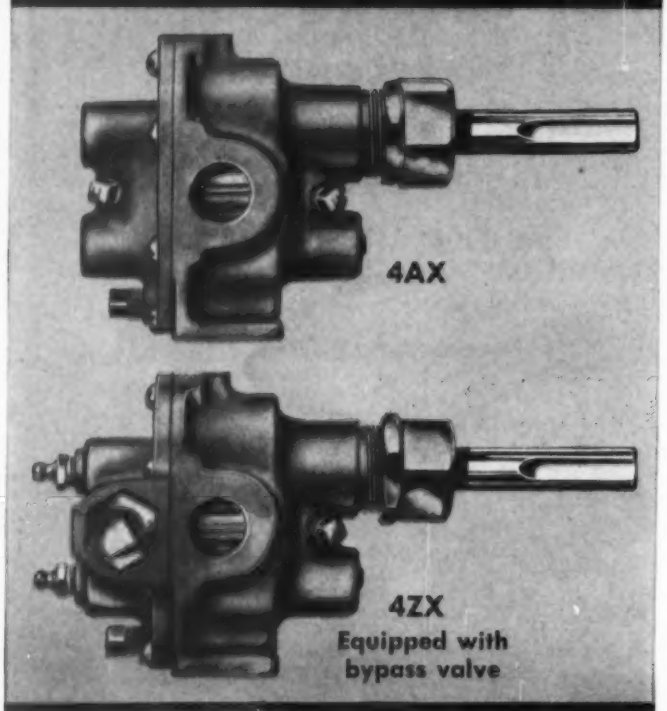
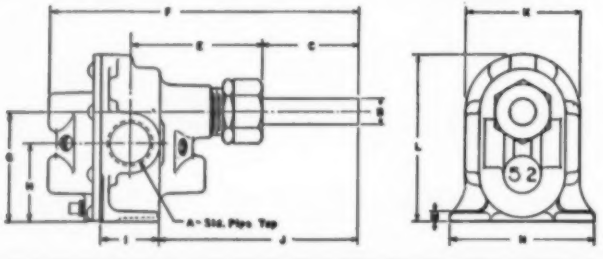
# Standard OBERDORFER Series 52 BRONZE ROTARY GEAR PUMPS




**CAPACITY TABLES** Gallons per minute — 1,725 R.P.M. — lbs. sq. in.

| Pump No. | 2 lbs. | 20 lbs. | 40 lbs. | 60 lbs. | 80 lbs. | 100 lbs. |
|---|---|---|---|---|---|---|
| No. 1½ | 2.10 | 1.92 | 1.75 | 1.63 | 1.55 | 1.50 |
| No. 2 | 4.10 | 3.75 | 3.58 | 3.42 | 3.25 | 3.17 |
| No. 3 | 7.42 | 7.08 | 6.75 | 6.50 | 6.33 | 6.17 |
| No. 4 | 10.67 | 10.17 | 9.67 | 9.17 | 8.83 | 8.50 |
| No. 7 | 19.75 | 19.33 | 19.00 | 18.67 | 18.33 | 18.08 |
| No. 9 | 23.33 | 22.92 | 22.50 | 22.08 | 21.67 | 21.33 |




**DIMENSION TABLE—SERIES 52 PUMPS**

| Pump No. | A | B | C Min. | E Max. | F | G | H | I | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1½ | ⅛ | ⅝ | 2 1/16 | 2 21/32 | 6¼ | 1⅞ | 1 13/32 | 1 1/16 | 4 1/16 | 1 15/16 | 2 27/32 | 3/16 | 2¼ | 1 5/16 |
| 2 | ⅛ | ½ | 1 7/8 | 2 31/32 | 6 9/16 | 2 23/64 | 1 29/32 | 1 9/32 | 4 1/32 | 2⅜ | 3 9/16 | ¼ | 2⅞ | 1 1/16 |
| 3 | ⅜ | ⅝ | 2¼ | 3 1/32 | 7 1/16 | 2⅝ | 1⅞ | 1 9/32 | 4 17/32 | 2¾ | 4 | ¼ | 3⅛ | 1⅛ |
| 4 | ½ | ⅝ | 2¼ | 3¼ | 7 1/16 | 2⅝ | 1⅞ | 1 13/32 | 4 25/32 | 2¾ | 4 | ¼ | 3½ | 1⅛ |
| 7 | ⅝ | ⅝ | 2¼ | 3 5/16 | 7 1/16 | 3 5/16 | 2 5/16 | 1 13/32 | 4 25/32 | 3⅜ | 5¼ | 5/16 | 4 | 1 5/16 |
| 9 | 1 | ⅝ | 2¼ | 3 5/16 | 7 1 1/16 | 3 5/16 | 2 5/16 | 1 21/32 | 4 25/32 | 3⅜ | 5¼ | 5/16 | 4 | 1 5/16 |

**PRICE LIST**

| Pump No. | No. 1½ | No. 2 | No. 3 | No. 4 | No. 7 | No. 9 |
|---|---|---|---|---|---|---|
| Pipe Size | ⅛" | ¼" | ⅜" | ½" | ¾" | 1" |
| AX | $11.25 | $13.25 | $15.50 | $17.00 | $22.50 | $23.75 |
| ZX | 15.25 | 17.50 | 20.50 | 22.00 | 27.75 | 29.00 |

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an Ermetto fitting could cause repetitive leaks. He suggested that tubing be inspected for this possibility. He suggested that inspection by maintenance personnel for faulty flares, tubes sprung out of shape and proper support of the tube against vibration would reduce such leaks. W. C. Lehman of United Airlines told of a tool developed by their San Francisco Maintenance Base that they had used very successfully to clean up the face of the fitting without removing the fitting from a majority of the units; adding that in most cases the reworked fittings look better and smoother than the new. J. M. Holland of Eastern Airlines ended the discussion by remarking that if a hydraulic system is designed to minimize hammering, that is, a pump and unloading valve combination that will give a minimum of pulsation and pressure surges and the system is installed right there will be a minimum amount of leaks.

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# Oil Power Speeds Handling of Pineapples

Continued from page 61

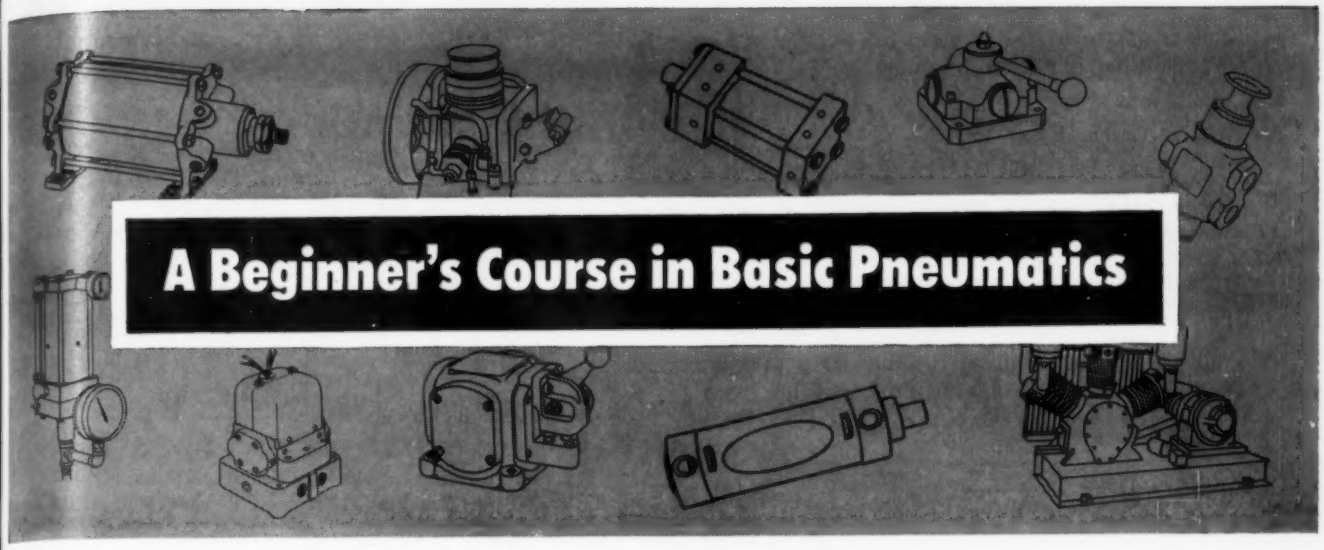
the pair of shafts to the end of the grader and falls onto a second 48 inch belt.

The two conveyor belts move side by side into the cannery proper, where they discharge the fruit onto two transverse 30 inch distribution belts 500 feet long. The distribution belts move in opposite directions, one taking the large fruit and the other the small fruit to the cutting and slicing machines.

Enroute to the distribution conveyors, the fruit is weighed and washed by a high pressure water spray. The belt control station, near the point where the 48 inch conveyor belts discharge into the 30 inch distribution belts, is the master control point. From this station the entire dumping and distribution system can be seen and controlled by one man. He controls the volume of fruit carried on the 48 inch conveyors by signals (light or address system) to the dumping station operators. He also balances the feed and return distribution belt loads by varying the proportion of fruit being fed to each. This is done on both belts by the operation of adjustable deflector operated by an air cylinder to give a proportional movement from full closed to full open.

The large size fruit is fed to a line of the "ginaca" machines. These are automatic sizing and coring machines, each capable of processing one hundred pineapples per minute. Automatic gates divert the fruit from the belt into chutes feeding into each ginaca machine. The gates are air cylinder operated, actuated by counter-weighted control valves near the top of each chute. As the pineapples accumulate in each chute, their weight depresses the control valve. This retracts the gate from the distribution belt. When the chute is nearly empty again, the counter-weight reverses the

Continued on page 92



# A Beginner's Course in Basic Pneumatics

## Section I

## Air Properties and Characteristics

### Part IV

### *The Gas Laws*

The three basic variables of the condition of air or a gas are pressure, volume and temperature. For a given quantity of air, or any gas, the third variable may be determined if the other two are known; if one variable is kept constant, the relation between the other two may be found.

In order to understand the compression of air, it is desirable that principles and laws concerning the behavior of air be clearly kept in mind. We will discuss two of the Gas Laws in this installment.

### *Boyle's Law*

The basic relationship between the pressure of a gas and its volume is known as Boyle's Law. This law states that at constant temperature, (a) the volume of a gas varies inversely as the absolute temperature, and conversely (b) absolute pressure is inversely proportional to volume. Stated as a simple formula this is:

$$\frac{\text{Initial absolute pressure}}{\text{Final absolute pressure}} = \frac{\text{Final volume}}{\text{Initial volume}} \quad \text{or}$$

Initial absolute pressure $\times$ initial volume = Final absolute pressure $\times$ final volume or

$$\frac{IP}{FP} = \frac{FV}{IV} \quad \text{or} \quad IP \times IV = FP \times FV$$

Therefore the final volume =

$$\frac{\text{initial absolute pressure} \times \text{initial volume}}{\text{Final absolute pressure}}$$

$$\text{or (a)} \quad FV = \frac{IP \times IV}{FP}$$

and final absolute pressure =

$$\frac{\text{Initial absolute pressure} \times \text{initial volume}}{\text{Final volume}}$$

$$\text{or (b)} \quad FP = \frac{IP \times IV}{FV}$$

Examples will illustrate these relationships.

(a) 40 cu ft of air at 30 psi, gauge, is compressed to 60 psi. What is the final volume?

Solve with the formula $FV = \frac{IP \times IV}{FP}$

IP = 30 plus 14.7 psi = 44.7 psi initial absolute pressure
FP = 60 plus 14.7 psi = 74.7 psi final absolute pressure

$\frac{44.7 \times 40}{74.7} = 25.4$ cu ft final volume

(b) Four cubic feet of air is confined at a pressure of 20 psi. What would the final pressure be if this air is compressed to two cubic feet?

Solve with formula $FP = \frac{IP \times IV}{FV}$

IP = 20 plus 14.7 psi = 34.7 psi initial absolute pressure (we will remember that absolute pressure is atmospheric pressure plus gauge pressure)

$\frac{34.7 \times 4}{2} = 69.4$ psi final absolute pressure

(if gauge pressure is required, subtract 14.7 psi from the absolute pressure; final gauge pressure would be 54.7 psi)

Let us take another pressure example. Ten cubic feet of air in a tank are at a pressure of 100 psi absolute. Water is forced into the tank till the air in the tank occupies only 1.5 cubic feet. What pressure does the air exert under this condition?

We again use the same formula, $FP = \frac{IP \times IV}{FV}$

$\frac{100 \times 10}{1.5} = 667$ psi absolute pressure or 652.3 psi gauge pressure.

## *Charles' Law*

Boyle's Law states the behavior of air at constant temperature; another law, Charles' Law, describes the behavior of air, or any gas, at constant pressure and constant volume. Charles' Law states that (a) at constant pressure, the volume of a gas is directly proportional to the absolute temperature; and that (b) at constant volume, the pressure is directly proportional to the absolute temperature.

(a) Constant pressure

At constant pressure, the volume of a gas is directly proportional to the absolute temperature. This may be written:

$$\frac{\text{Initial volume}}{\text{Final volume}} = \frac{\text{Initial absolute temperature}}{\text{Final absolute temperature}} \text{ or}$$

$$\frac{\text{Initial absolute temperature}}{\text{Initial volume}} = \frac{\text{Final absolute temperature}}{\text{Final volume}} \text{ or}$$

$$\frac{IV}{FV} = \frac{IT}{FT} \text{ or } \frac{IT}{IV} = \frac{FT}{FV}$$

Therefore the final volume $= \frac{\text{Initial volume x Final temperature}}{\text{Initial temperature}}$

or $FV = \frac{IV \times FT}{IT}$

To illustrate by example: 500 cubic feet of air is enclosed at atmospheric pressure and 80 F. A heating coil raises the temperature to 250 F. The air expands through a valve at atmospheric pressure into another tank. What is the volume of air that passes into the second tank?

We solve with the formula $FV = \frac{IV \times FT}{IT}$

IT = 460 plus 80 F = 540 F initial absolute temperature
FT = 460 plus 250 F = 710 F final absolute temperature

$\frac{500 \times 710}{540} = 657$ cu ft final volume

657 − 500 = 157 cu ft passed into second tank.

(b) Constant volume

At constant volume, the pressure of a gas is directly proportional to the absolute temperature. This may be written:

$$\frac{\text{Initial pressure}}{\text{Final pressure}} = \frac{\text{Initial absolute temperature}}{\text{Final absolute temperature}} \text{ or}$$

$$\frac{\text{Initial absolute temperature}}{\text{Initial pressure}} =$$

$$\frac{\text{Final absolute temperature}}{\text{Final pressure}} \text{ or}$$

$$\frac{IP}{FP} = \frac{IT}{FT} \text{ or } \frac{IT}{IP} = \frac{FT}{FP}$$

Therefore the final pressure $=$

$$\frac{\text{Initial pressure} \times \text{Final absolute temperature}}{\text{Initial absolute temperature}}$$

or $FP = \frac{IP \times FT}{IT}$

To illustrate by an example: 300 cubic feet of air at atmospheric pressure and 85 F is put under increased pressure until the temperature is 500 F. What is the final gauge pressure?

We solve with the formula $FP = \frac{IP \times FT}{IT}$

IT = 460 plus 85 F = 545 F initial absolute temperature
FT = 460 plus 500 F = 960 F final absolute temperature

$\frac{14.7 \times 960}{545} = 25.9$ psi absolute pressure

25.9 − 14.7 = 11.2 psi gauge pressure.

*The next installment will discuss combinations of Boyle's and Charles' Laws and the Perfect Gas Law.*

## All of the Carbon Dioxide

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## because of a special U-Packing you can place on a dime!

LEAKING valves were causing real trouble to this manufacturer of carbon dioxide portable fire extinguishers. His valve design was OK: a plunger-actuated poppet providing quick, full flow, opened by depressing the spindle (by means of a lever on the carrying handle) and returned to the closed position by a strong spring.

His trouble lay in his seals — a mechanical packing on the spindle and a poppet washer for the seat. Tests showed that they leaked, permitting the carbon dioxide to escape.

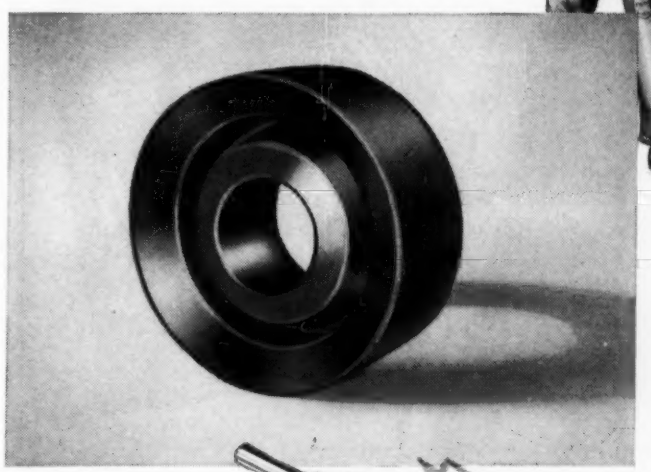
Sample packings with the valve assembly were sent to G&K–INTERNATIONAL for study. As a result of engineered research, synthetic rubber compounds were developed, impervious to carbon dioxide and capable of withstanding long periods of aging.

For the spindle, G&K–INTERNATIONAL engineers designed a special U-shaped packing, leak-proof and flexible to form a perfect mechanical seal between the stem and the packings recess.

The poppet seat called for a hard, tough rubber, molded dead-even-flat on each face. It had to form a compression seal that would remain tight for years, if need be.

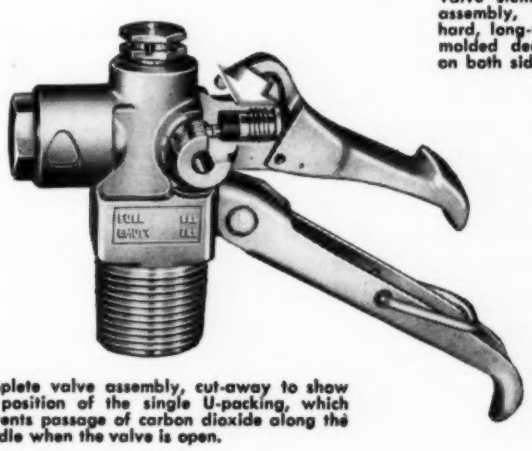
Results? To quote this manufacturer, "The valves passed Underwriters and U. S. Navy tests and are doing a wonderful job."

Be sure you get the correct type of packings made from compounds engineered for your requirements. Send us complete specifications of your packings needs and G&K–INTERNATIONAL Engineers will help you solve your packings problems — before trouble starts.



Photograph shows special U-type synthetic packing enlarged 3½ times. Assembly locates this packing on the spindle.

Valve stem and poppet assembly, showing the hard, long-wearing seat, molded dead-even level on both sides.



Complete valve assembly, cut-away to show the position of the single U-packing, which prevents passage of carbon dioxide along the spindle when the valve is open.

second century G and K –INTERNATIONAL

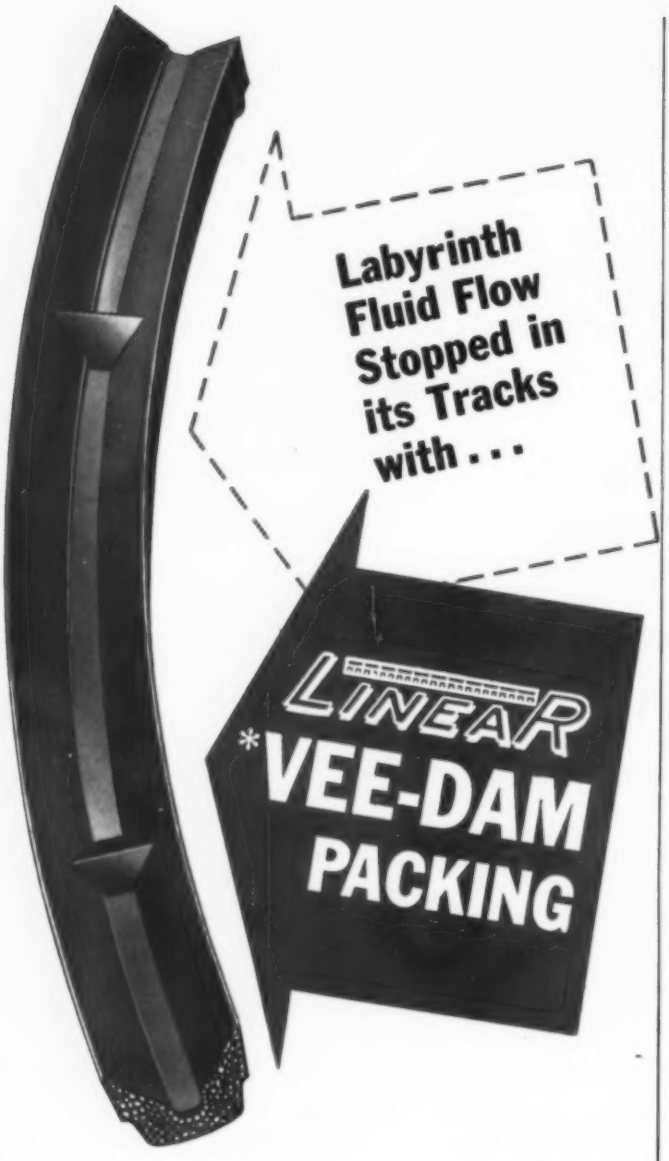
GRATON AND KNIGHT ESTAB. 1851

**Leather and synthetic packings**

**GRATON & KNIGHT COMPANY**
**Worcester 4, Mass.**

**INTERNATIONAL PACKINGS CORPORATION**
**Bristol, New Hampshire**

Circle 40 on Reader Service Card




The sealing advantages of solid ring packings over the easier installed split rings no longer exist.

**VEE-DAM** Rings are LINEAR's approach to an old packing problem—leakage. To achieve this, fluid control at the hinge area is a must even if an actual gap occurs at the joint.

When gaps do occur in more than one ring, VEE-DAM fabric reinforced seals, designed with sturdy abutments or dams, provide positive, hermetic sealing against all labyrinth flow or lateral passage of fluid.

Use in the toughest of applications have proved that VEE-DAM Rings are the answer sought by hydraulic engineers for the past quarter century. Write on your company letterhead for full details.

*Patent applied for

"PERFECTLY ENGINEERED PACKINGS"
LINEAR
LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA.

Circle 65 on Reader Service Card

Concluded from page 86

valve and the gate again moves across the distribution belt, diverting a fresh supply of pineapples into the chute.

Subsequent operations include trimming, slicing, packing and processing.

Each of the dumping lines has a capacity of 7 to 8 bins per hour providing a cannery capacity of over 5 tons of fruit per minute.

## Pressure Switch Reversal of Pierce Tools

Concluded from page 67

should so desire in case a piece has been loaded wrong, or something else requires immediate reversal.

Because no springs are used in the four-way valve, momentarily pressing the start buttons shifts the valve. Releasing the start buttons deenergizes the forward solenoid, however the valve spool does not move until the return solenoid is energized to shift it.

In the hydraulic circuit the high pressure relief valve protects the pump from overload. The low pressure relief valve in the rod end line dumps oil to tank during no work, (when the machine is being loaded and unloaded). Use of the low pressure relief valve for this purpose instead of one high pressure valve for safety and unloading reduces heat generation and power consumption.

## Power Package Revamps Extrusion Press

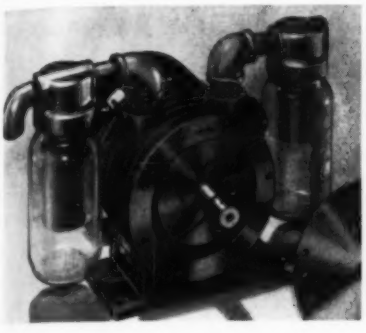
Concluded from page 63

drives the ram smoothly to the end of its stroke. The low pressure relief valve in the high pressure return line is set at 600 psi. A manual by-pass valve in the high pressure return line may be used to dump the oil quickly to permit the high pressure pump to idle at no load or it may be used to check the pump deliveries. Both pumps run continuously.

Two basic types of plastic packing are extruded on the press—square spiral die-formed and round straight with braided jacket. On the original press a large percentage of waste, up to 75 percent on some difficult mixes and averaging 30 percent, was caused by cracking of the extruded material as it left the die nozzle. This has been entirely eliminated since the piston type high pressure pump was installed due to the pulsation free discharge pressure obtained with this type pump as compared with the old slower speed triplex pump.

The redesigned extruder and double pump unit has been in operation for approximately six months and its service has been entirely satisfactory. The installation has practically eliminated spoilage waste and tripled production per man hour.

# application and performance of NEW COMPONENTS



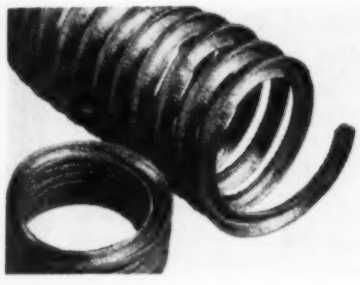
### Oil-less Air Pump

*Gast Manufacturing Corporation, Benton Harbor, Michigan*

**Models:** Three available models. All produce up to 20 in vacuum, and up to 10 psi. Model 0740 delivers from 3.5 to 5.6 cfm, Model 1550 from 8 to 10.5 cfm, and Model 3040 from 17 to 24 cfm according to rpm selected.

**Design:** Four vanes of carbon sliding in slots in the rotor lubricate themselves to eliminate the necessity for oiling. Ball bearings are grease sealed for life, and ventilated space between bearings and pumping chamber prevents grease from entering the chamber. There are no body or plate spacer gaskets, no shaft seal, and no lubricator.

**Circle 151 on Reader Service Card**



### "V" Packing

*Mechanical Packing Division, Flexrock Company, Philadelphia, Pa.*

**Designation:** Flexrock "Continuous-Vee" Packing.

**Sizes:** Furnished from ¼ to 1 in. by 1/16 in. increments, 25 feet per spiral.

**Service:** Designed for 500-600 psi and available in styles for either high or low temperatures. User cuts his own rings on the job to fit specific rod and stuffing box dimensions. No. 2005 is constructed of asbestos cloth and neoprene.

**Circle 152 on Reader Service Card**

### Pneumatic Test Stand

*Sprague Engineering and Sales Corp., Gardena, California*

**Designation:** Model S-421 Pneumatic Test Stand

**Service:** For performing functional tests on components of aircraft and guided missile pneumatic systems.

**Operation:** Provides three separately regulated test outlets with ranges of 0-200, 0-2000 and 0-6000 psi. Two flowmeters, which measure leakage, have ranges of .01 to .24 cfm and 2 to 28 cim, respectively.

**Size:** All components are mounted in an all-enclosed, steel welded and reinforced cabinet, measuring 72 in. wide, 36 in. deep and 74 in. high.

**Circle 153 on Reader Service Card**

### Piston Rod Protection

*A & A Mfg. Co., Milwaukee, Wisconsin*

**Designation:** Gortite Sleeve.

**Service:** Telescopic sleeve used to protect hydraulic rams from damage due to dirt or water, chips, oil or grease.

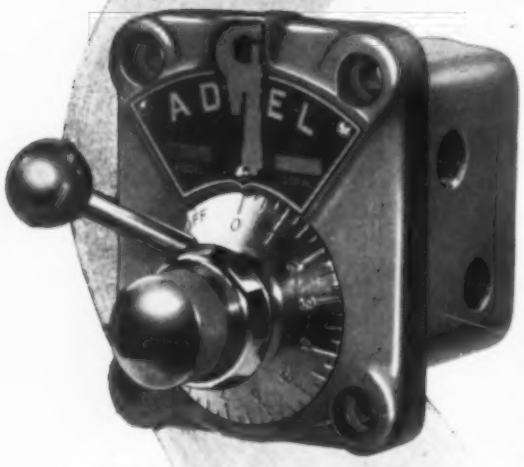
**Sizes:** Standard accordian telescopic sleeves range in size from ⅝ in. ID to 8¼ in. ID with a maximum open length of 24 inches and a minimum closed length of approximately 2 inches depending upon the diameter. Sizes up to 24 in. diameter and 30 ft. long can be made to order.

**Material:** A special neoprene which withstands temperatures within a range of −45 to 220 F. without cracking.

**Circle 154 on Reader Service Card**

THE NEW **ADEL**

## FLOW CONTROL VALVE FOR VERSATILITY



Adjustable from completely shut off position to 25 G.P.M. maximum flow. Will maintain constant fluid flow and constant machine feed over a wide range of pressures and feed resistances.
The diagrams show but two of innumerable circuits and systems where this versatile and better valve can be used to advantage.

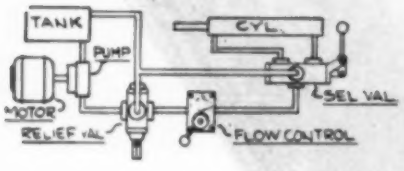



Diagram illustrates typical circuit showing control of cylinder.

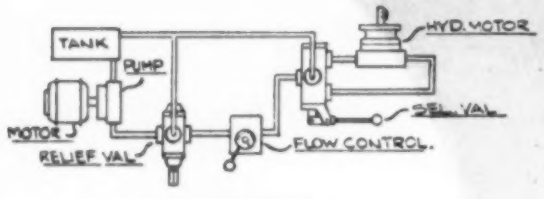



Diagram illustrates typical circuit showing control of hydraulic motor.
8 model variations are available—⅜ in. Pipe Size—1, 2, 4 & 6 G.P.M. Flow Max.
¾ in. Pipe Size—10, 15, 20 & 25 G.P.M. Flow Max.

**CHARACTERISTICS**

1. Valve is compensated type which maintains substantially a constant flow regardless of variation in inlet and outlet pressure.
2. Maximum recommended inlet pressure 1500 P.S.I.
3. Maximum recommended outlet pressure equals inlet pressure minus 100 P.S.I.
4. No drain line required.
5. Wide range of control lever rotation (270°) permits extremely accurate flow settings.

A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF HYDRAULIC EQUIPMENT. INQUIRIES INVITED.

For complete engineering specifications and counsel, Address: ADEL DIVISION—GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California.

ADEL LEADER IN HYDRAULICS

DIVISION OF GENERAL METALS CORPORATION · Burbank, Calif.

*Manufacturers of Industrial Hydraulic Control Equipment*

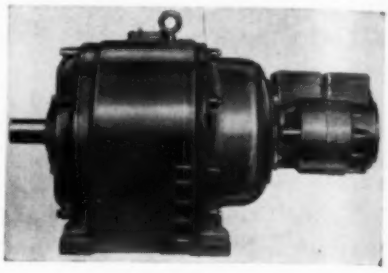
DISTRIBUTORS: AIR & HYDRAULIC CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND, OREGON • J. BOYD COATES, PHILADELPHIA, PA. • FRANK T. DONNELLY COMPANY, PITTSBURGH, PA. HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO, CALIF. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE, CALIF. • HYDRAULIC BRAKE SUPPLY CO., PHOENIX, ARIZ. • LINCOLN SUPPLY CO., PROVIDENCE, R. I. • SCOTT EQUIPMENT AND ENGINEERING COMPANY, DAYTON, OHIO • H. F. SODERLING CO., SEATTLE, WASH. • ROBERT TAYLOR & SONS, SALT LAKE CITY, UTAH • WYATT SALES COMPANY, CLEVELAND, OHIO • CORBY SUPPLY COMPANY, ST. LOUIS, MO. • INDUSTRIAL AIR & HYDRAULIC EQUIPMENT CO., DETROIT, MICH. • HYDRAQUIP CORPORATION, HOUSTON, TEX.

Circle 3 on Reader Service Card


### Fluid Powered Speed Reducer

*The Rucker Manufacturing Co. Oakland, California*

**Service:** Makes available all the gear ratios of conventional speed reducers with complete control of motor speed from 0 to 200 rpm, at constant torque and with full reversibility; also extreme torque down to 1 rpm. Permits instant changes in machine speeds to fit the job.



**Design:** A specially designed hydraulic motor replaces the conventional electric motor as a power source. The fluid motor is explosion proof. The model shown has a vane type motor, but piston type motors will be available later.

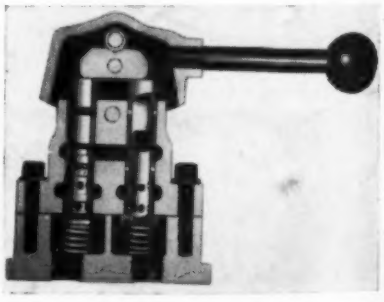
**Sizes:** Up to 100 hp input, with larger sizes custom built to meet specific job conditions.

Circle 155 on Reader Service Card

### Improved Air Control Valves

*Numatics, Milford, Michigan*

**Service:** Directional air control for pressures to 150 psi.



**Design:** Neutral position of lever is maintained by two light springs located directly underneath lower poppets. The seats are made of especially-molded oil-resistant and high impact re-

sistant material. Three types of rockers, locking, nonlocking and a combination of the two are available. All pins, rollers and rockers, and the upper wearing surface are hardened. Lower poppets are high tensile brass.

Circle 156 on Reader Service Card

### Air Valve

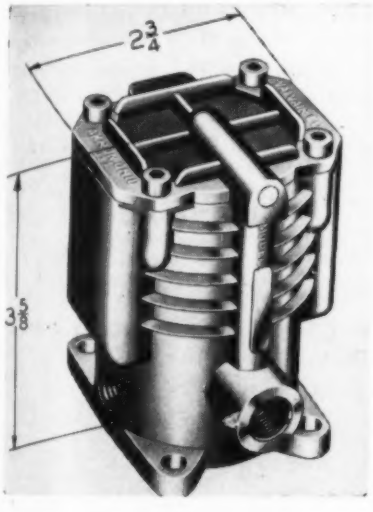
*Valvair Corporation, Akron, Ohio*

**Type:** 2-and 3-way; solenoid operated; 110, 220 and 440 volts; either normally open or normally closed.

**Sizes:** ¼, ⅜, ½, ¾ and 1 in.

**Application:** Recommended as pilot valve for cylinder or diaphragm operated valves.

**Design:** Zinc alloy die cast body; stainless steel seats, plunger and spring; Hycar seats in both ends of the plunger. All valves have




¼ in pipe tap. Inrush current consumption is 41 watts, holding current is 27 watts. For service at pressures to 125 psi air or oil.

Circle 157 on Reader Service Card

### Fixed Displacement Pumps

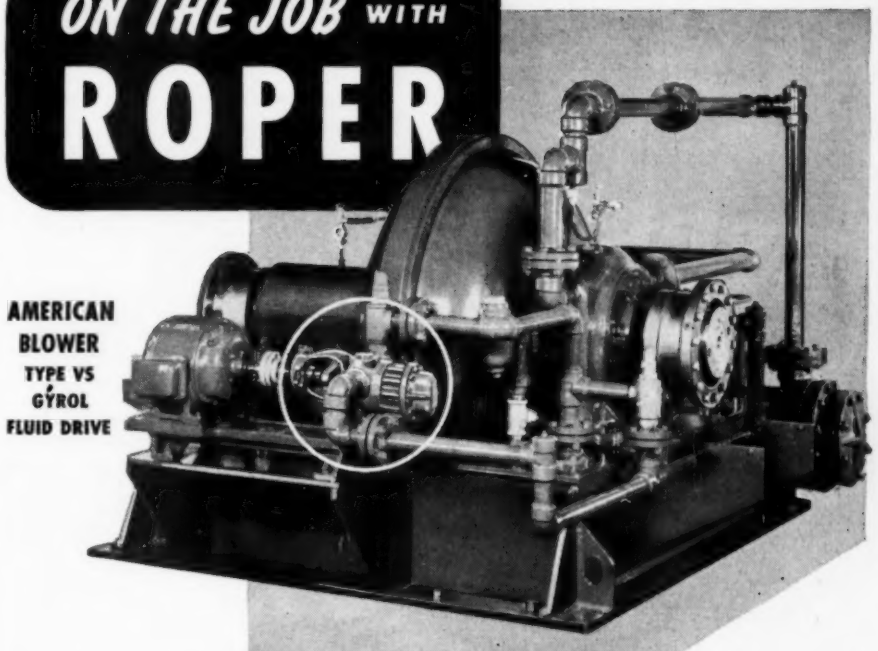
*Vickers Incorporated, Detroit, Michigan*

**Sizes:** Two and three gallon sizes at 1500 rpm.

**Designation:** Models PFA2, PFA3Y-2, PFA3A-2. The latter two models differ only in the type of mounting pad.

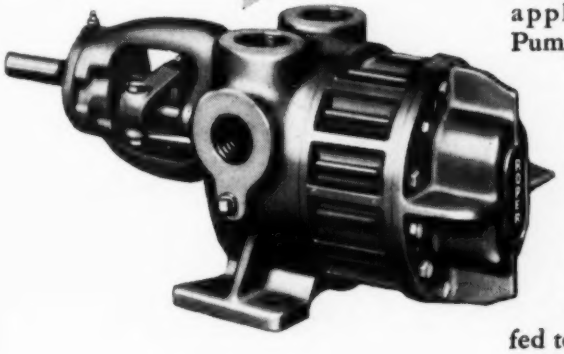
**Specifications:** AN approval for


ON THE JOB WITH ROPER



AMERICAN BLOWER TYPE VS GYROL FLUID DRIVE

ANOTHER EXAMPLE SHOWING ROPER PUMPS AS INTEGRAL PARTS OF MODERN MECHANISMS



Gyrol Fluid Drives — for supply pumps, compressors, draft fans, and other industrial applications — use Roper Pumps to govern speed variation. In this model, the oil is taken from the oil reservoir and is added to the Fluid Drive working circuit to increase speed, or oil is removed from the circuit to decrease speed. The lubricating oil is constantly fed to all bearings. The Fluid Drive unit shown is a size 27 Type VS with maximum ratings of 518 HP at 1400 RPM.

SERIES F PUMP

Roper Series F Pumps — the models used as original equipment on Gyrol Fluid Drives — are recommended for pressures up to 300 PSI and come in 1 — 300 GPM sizes. They feature 4-port design offering eight optional piping arrangements (4 for CW and 4 for CCW rotations) . . . a factor which cuts installation time and costs. Equal size gears run in axial hydraulic balance; pumps furnished in standard or stainless steel fitted models; available with or without relief valve — with mechanical seal or packed box. Investigate what Roper Rotary Pumps can do for you!

SEE OUR CATALOG IN SWEET'S

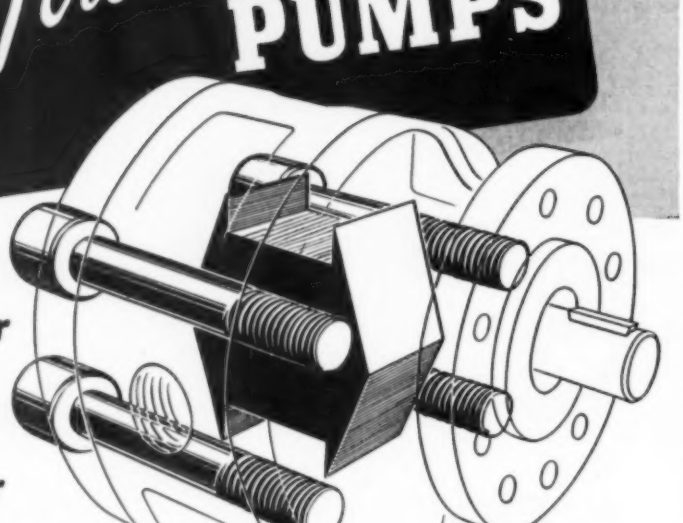
GEO. D. ROPER CORP.
705 BLACKHAWK PARK AVE.
ROCKFORD • ILLINOIS

ROPER Rotary Pumps

Circle 96 on Reader Service Card

DO YOU USE *Oil Hydraulics?*

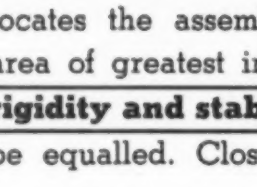
**HYDRECO** *Four Bolt* **PUMPS**



***Give Longer Life With Higher Efficiency***

***For Hydraulic control systems of— Earth Moving—Road Building— Materials Handling Equipment***

***HYDRECO FOUR-BOLT DESIGN . . .*** locates the assembly bolts close within the area of greatest internal pressure — insuring **rigidity and stability** in design that cannot be equalled. Closer internal clearances are permanently built into the pump. There are no complicated internal mechanisms to "foul-up" from dirty oil.



***Write for Catalog and Full Information***

**HYDRAULIC EQUIPMENT COMPANY**
**1104 EAST 222nd STREET • CLEVELAND 17, OHIO**

Circle 51 on Reader Service Card

aircraft applications. Rated as 3000 psi pumps, volumetric efficiency is 98 percent and overall efficiency is 92 percent. The PFA2 generates 1.9 hp per pound of weight. Negligible pressure pulsations. Design life is uprated about 40 percent over

Vickers Model PFA2

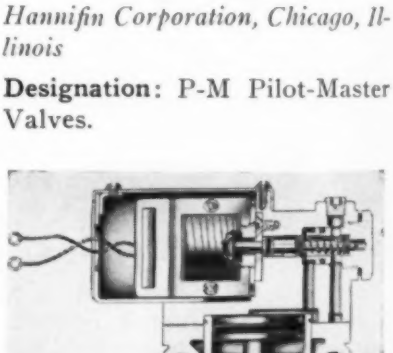
the older models. The AN approved pumps were designed with straight thread female tubing fittings per specification AND-10050. To make the new pumps interchangeable with older models, they can be fitted with special valve plates having different fittings.

Circle 158 on Reader Service Card

### Air Valves

*Hannifin Corporation, Chicago, Illinois*

**Designation:** P-M Pilot-Master Valves.



**Service:** 2-way, 3-way and 4-way directional control of air pressures up to 150 psi.

**Sizes:** Series B 3-way valves: ⅜, ½, ¾, 1, and 1¼ in. Series BB 4-way valves: ⅜, ½ and ¾ in.

**Design:** Pictured here is the 3-way master valve with a sole-

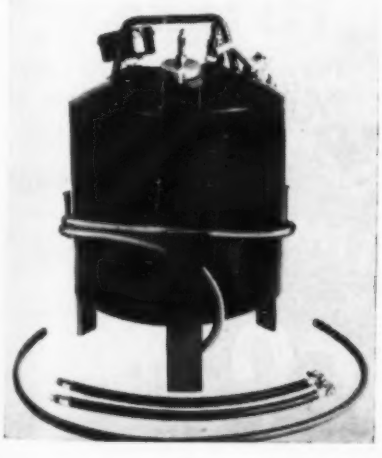
noid pilot head having a spring return. A pressure return type pilot head is also available. Basically, the valve is a poppet type, operated by pressure from an integral pilot head or a remote pilot valve. There are 10 models of series C pilot valves designed for the remote control of master valves. Each of the ten has a different actuating mechanism. The master valve features a removable cartridge which is replaceable without breaking main piping connections. The valves are corrosion resistant, provide full pipe capacity and do not have a return spring in the main valve. Internal pressure returns the piston-poppet.

Circle 159 on Reader Service Card

### Hydraulic Line Servicing Unit

*Superdraulic Corporation, Detroit, Michigan*

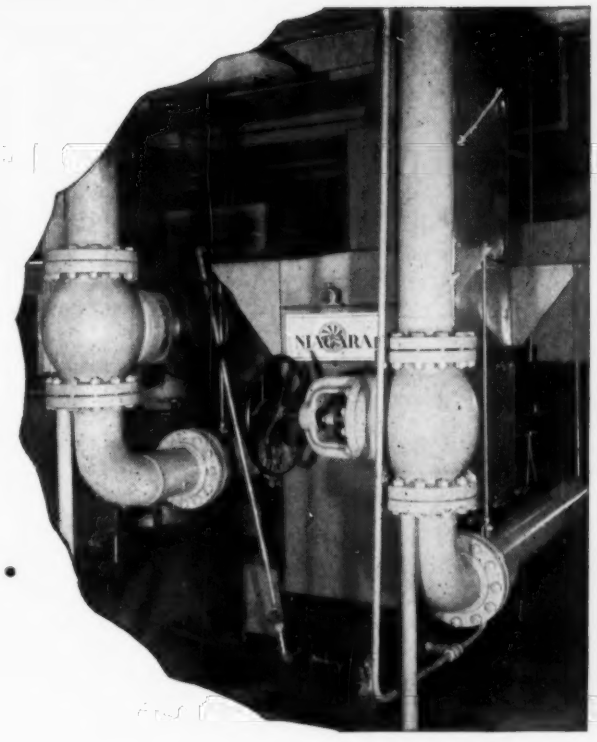
**Application:** This filling-bleeding tank is used for servicing hydraulic lines on automotive, aircraft and industrial equipment.



**Design:** Unit meets military specifications No. MIL-T-5182. Holding 2½ gallons of oil, it is equipped with filler cap, air inlet valve, pressure gauge, relief valve, automatic shut-off valve within the tank, dispensing hose and control valve. The unit is capable of operating efficiently at a temperature range of from minus 65 to plus 130 F. and is proof pressure tested at 300 psi.

Circle 160 on Reader Service Card


**How to get drier or cooler gases . . .**



NIAGARA AERO AFTER COOLER cools a compressed gas, or air, below the temperature of the surrounding atmosphere, thus preventing the condensation of moisture in your lines. The gas will contain only half of the moisture left in it by conventional methods. Even drier gas can be produced if you require it.

In working with controlled atmospheres of inert gases to prevent undesired reactions, this dryness of the gas at low cost is a great advantage. The cost of the Niagara method is low because it uses evaporative cooling, saving 95% of the cost of cooling water (and its piping and pumping). This direct saving of cost pays for the Niagara cooler in less than two years.

If you use compressed air to operate tools or pneumatic equipment you save much in water and oil damage to tools and equipment, and in water damage to materials by using the Niagara Aero After Cooler.

Write for a bulletin, or ask nearest Niagara Field Engineer if you have a problem involving the industrial use of air.

**NIAGARA BLOWER COMPANY**

Over 35 Years' Service in Industrial Air Engineering

**Dept. AH, 405 Lexington Ave.** **New York 17, N. Y.**

*Experienced Field Engineers in Principal Cities of U. S. and Canada*

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Circle 6 on Reader Service Card


STAMP OF APPROVAL

Parco

KOBE Heavy Duty High Pressure

# Triplex Pumps

*Case History A6:* For nine years the Kobe Triplex in Plastic and Rubber Products' (Parco "O" rings) Los Angeles plant has operated 36 presses at 2800 p.s.i., 24 hours a day, 5 days a week.

*Never a Shut-Down*

Superintendent of Maintenance, J. J. O'Connor, reports that the pump has never been shut down for maintenance. Each year when the plant has closed for vacation he has inspected and replaced worn parts. However, there has never been a complete overhaul on the pump.

*Another Triplex ordered for Houston Parco Plant*

Best indication of Parco satisfaction with the Kobe Triplex is specification by the Company of another unit in their nearly-completed Houston plant.

*Features:*

- Pressures — To 5,000 psi (standard) To 20,000 psi (special)
- Volumes — To 60 g.p.m.
- Power Ratings — 15, 30, and 50 H.P.
- Integral Double Reduction Gears
- Integral Electric Drive (Optional)
- Easily interchanged Plungers and Liners

*Write for Bulletin*

KOBE INC., Division of Dresser Equipment Co., 615 NBC Bldg., 815 Superior Ave., N.E. Cleveland 14, Ohio

KOBE INC.
Division of Dresser Equipment Co.
Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.


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A MONEY-BACK GUARANTEE OF

# LONGER SERVICE

MANY OF AMERICA'S LARGEST PUMP MANUFACTURERS RELY ON

PROMET — THE Engineered BRONZE

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- Thrust Plates
- Bearing Plates
- Pressure Plates
- Connecting Rods
- Bushings
- Seals

Machined or rough cast and of the specific formula best suited to the application.

Send blueprints, conditions of operation and other data for recommendations and quotations.

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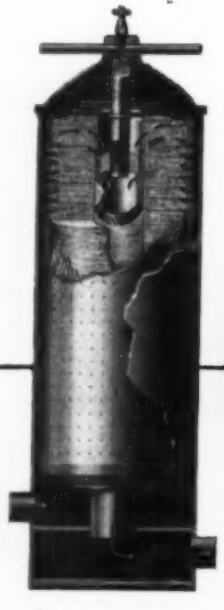

FILTER

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They Keep Your Oil Clean By Removing Products of Oxidation Acids, Sludge and Moisture

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•

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FILTERS WILL PREVENT SLUDGING, PUMP AND VALVE FAILURES . . .

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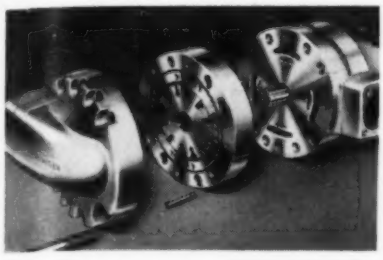
### 2000 PSI Vane Type Pump Motor

*The Denison Engineering Company, Columbus, Ohio*

**Service:** The unit may be used as a pump or motor giving a constant displacement for continuous service up to 2000 psi.



**Sizes:** As a pump the 8 models have volume capacities from 5 to 60 gpm; as a motor the 8 models have torque capacities from 19 to 230 inch-pounds per 100 psi. The unit is built in three sizes, each offering interchangeable cam rings for various volume or torque requirements to provide the eight different pump and motor capacities.

**Design:** Single stage incorporating a new principle of radial balance. The unit permits either clockwise or counter-clockwise rotation, for both pump or motor operation. The vanes in the unit feature dual sealing edges that assures better valving action at point of exhaust. The exploded view of the pump/motor shows the three component compact construction. The pumping cartridge, positioned by only two screws, is easily turned over when reverse rotation is desired.

Circle 161 on Reader Service Card

### Mechanical Shaft Seal

*Cartriseal Corporation, Chicago, Illinois*

**Service:** A newly designed, positive mechanical shaft seal to withstand high pressures, high temperatures and high rpm. Used on hydraulic transmissions.

**Features:** Compact design, having the feature of hydraulic balance and low unit load pressures to insure longer life.

Circle 162 on Reader Service Card


# DIAPHRAGMS
## Industry's Rubber Lungs

**One of Acushnet's many specializations is in the field of diaphragms. We have achieved notable success in the design and production of all types of diaphragms, with or without fabric insert, from the size of a dime up to three feet in diameter.**

**Special stocks are compounded to resist various fluids and gases, extreme high and low temperatures, continued flexing, or combinations of these requirements. We are equipped to produce diaphragms bonded to metal. Problems involving the most meticulous specifications are invited.**

Acushnet
**PROCESS COMPANY**
New Bedford, Mass., U. S. A.

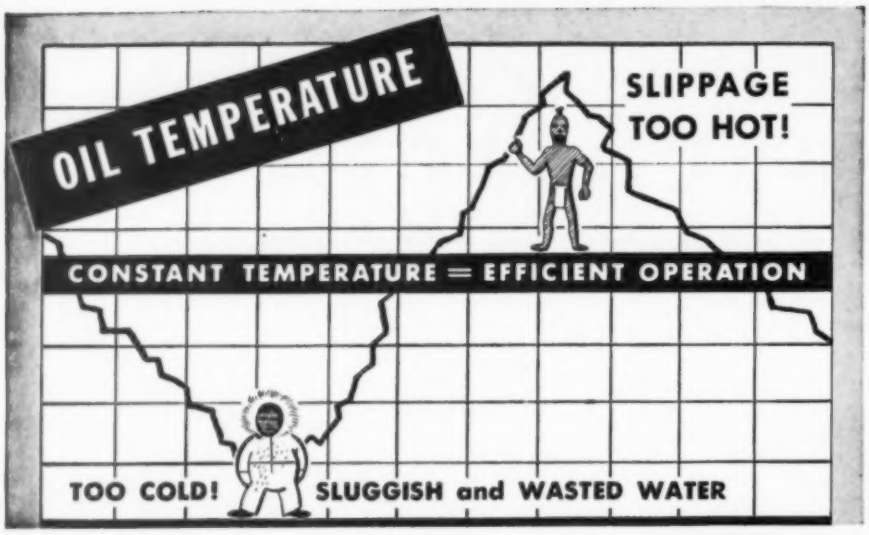
**Diaphragms are made on order to specifications, none are stocked.**

ARMY E NAVY

*Rubber Handbook sent on request*

***Address all communications to 794 Belleville Ave., New Bedford, Mass.***

Circle 2 on Reader Service Card



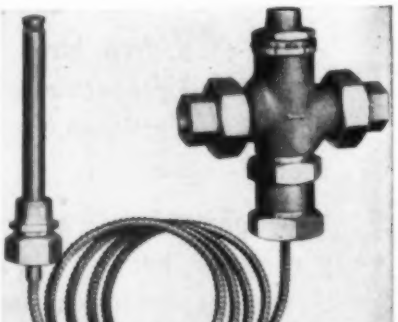

# *Keep* OIL TEMPERATURE CONSTANT *for* EFFICIENT *Trouble-free* OPERATION

Bring your existing equipment up to the hydraulic fluid cooling standards recommended by J.I.C.* with a Sterlco Automatic Temperature Control Unit installed in your heat exchange system. Easy to install . . . eliminates the human element at the cooling valve.

Remember, oil too hot means slippage . . . too cold means sluggish operation with wasted cooling water.

## *Sterlco* SERIES 150E TEMPERATURE CONTROL

- **COMPLETELY AUTOMATIC** — Once installed and set at proper temperature no further adjustment necessary.
- **SELF-CONTAINED** — Consists of thermostat bulb, capillary tube and valve.
- **EXTREMELY COMPACT** — Does not require great space for installation.
- **MOUNTS ANY POSITION** — Works as well vertically (right side up or upside down) —horizontally or at an angle.



**INEXPENSIVE, TOO!** You will be amazed at the low cost of the Sterlco Series 150E Temperature Control. In actual operation an installation of several units has paid for itself in less than 3 months in savings of water alone.

**SEND FOR COMPLETE DETAILS NOW**

MANUFACTURERS OF TEMPERATURE CONTROL EQUIPMENT SINCE 1916

* J.I.C. (Joint Industry Conference) paragraph H5.10 states: "When heat exchangers are used, they shall be equipped with suitable automatic thermal controls."

INDUSTRIAL CONTROL DIVISION
**STERLING, INC.**
3742 N. Holton Street • Milwaukee 12, Wis.

Circle 108 on Reader Service Card


### Hydraulic Power Pack

*Dowty Equipment, Ltd., Cheltenham, Glos., England*

**Designation:** The Ambassador Power Pack.

**Size:** Pump delivery .43 gallons per 1000 revolutions at normal pressure range from 2000 to 2500 psi.

**Application:** Developed for use in the Airspeed Ambassador Twin Engined air liner. A similar unit is supplied for use in the Giant Saunders Roe "Princess" flying boat.

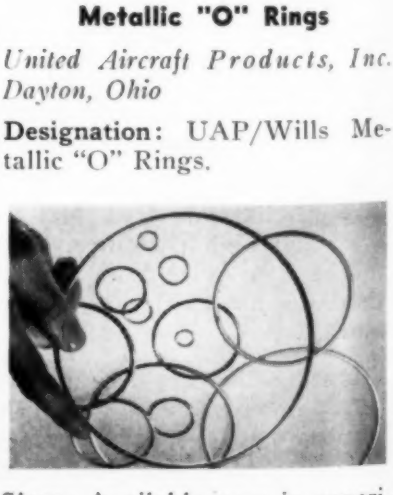
**Design:** A 5 hp variable speed electric motor is coupled to a three cylinder radial pump mounted in the side of the reservoir. The unit is compact— 29¾ x10¼x12 inches and weighs only (dry weight) 45 pounds. Reservoir capacity is 33 pints. Overall pump efficiency is 80 percent at maximum speed and pressure. Inlet ports in the cylinder walls reduce the number of valves to a minimum. The Power Pack is easy to install and maintain, a separate pressure switch automatically controls the motor to eliminate idle running and unnecessary wear of mechanical parts.

Circle 163 on Reader Service Card

### Metallic "O" Rings

*United Aircraft Products, Inc. Dayton, Ohio*

**Designation:** UAP/Wills Metallic "O" Rings.



**Sizes:** Available now in experimental quantities in sizes rang-

ing from 11/16 to 40 in OD in increments of 1/16 in.

**Service:** Static sealing wherever problems of heat, pressure, corrosive liquids or gases are involved. Will hold against pressures as high as 20,000 psi and withstand temperatures limited only by the "physicals" of the metal.

**Design:** Hollow metal tubing rings filled with inert gas at 600 psi.

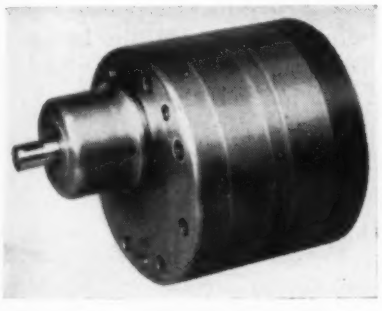
Circle 164 on Reader Service Card

### High Pressure Gear Pump

*Keelavite Company, Ltd., Coventry, England*

**Sizes:** 3 to 60 gpm; continuous duty rating of 2000 psi; peak loading of 2500 psi.

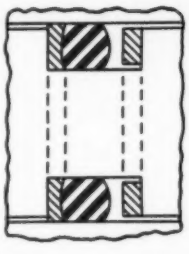
**Application:** Designed for use with large pumps for press operation, plastic molding and other operations demanding a long curing cycle at high pressure. By slight internal rearrangement, the unit can be used as a highly efficient hydraulic motor.



**Design:** Gears are located axially and radially entirely by hydraulic pressure, no mechanical centering devices are used. Volumetric efficiencies approaching 90 percent can be maintained through all loading conditions; the absence of friction between gears and casing insure high mechanical efficiency with maximum life. An outstanding feature is the quietness of operation at 2000 psi; at this pressure only the motor noise is audible.

Circle 165 on Reader Service Card


**TEFLON* PACKINGS**
**for Hydraulic & Pneumatic Cylinders, Presses, Pumps, Valves**



**CHEMISEAL BACK-UP RINGS**
**Protect Packing — Lengthen Its Life**

For protecting O-rings and other packing from extrusion, deterioration and loss of efficiency—select Chemiseal Back-up Rings, made of Teflon—a natural for hydraulic service.

These rings are chemically inert, can't be affected by oils or solvents. They won't harden, soften, swell or shrink in service. Tough, resilient, they support the packing with which they are used, greatly lengthen its life. Try them, and you will standardize on them.

**CHEMISEAL V-TYPE PACKING**

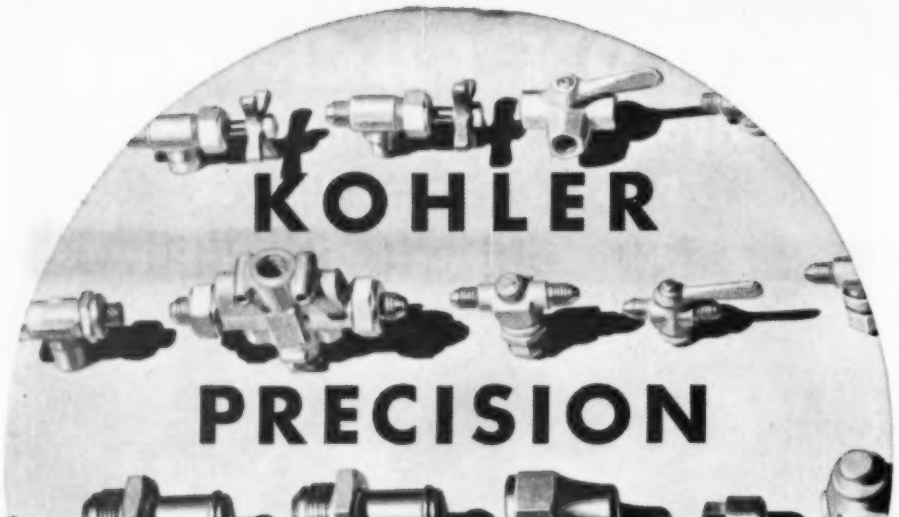
The ideal valve packing that seals with low gland pressures and operating torque, made from solid Teflon or Teflon compounds. Extremely resilient, tough and anti-hesive—it cannot seize the valve stem or shaft—is long wearing, impervious to all hydraulic fluids, outlasts other packings several times over. Supplied in sets with square-end Teflon adaptors. Send for catalog No. 810 V.

*du Pont's trademark for its tetrafluoroethylene resin

**UNITED STATES GASKET COMPANY**

**FLUOROCARBON PRODUCTS DIVISION**
FABRICATORS OF "TEFLON", "KEL-F" AND OTHER FLUOROCARBON PLASTICS
**CAMDEN 1, NEW JERSEY**

Circle 115 on Reader Service Card




## *Aircraft • Industrial • Automotive*

Kohler Co. is a leading supplier of precision controls to manufacturers of jet engines, military, commercial and private aircraft, agricultural and industrial test equipment, Diesel engines, automobiles, trucks, and tractors.

Facilities for forging, die casting, machining, anodizing, are maintained all in one plant—with an experienced organization skilled in precision workmanship.

Our engineers develop, for volume production, valves and fittings and kindred equipment to specification. Write for illustrated catalog.

Kohler Co., Kohler, Wisconsin. Established 1873

KOHLER OF KOHLER

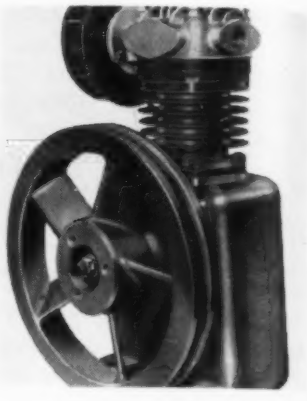
PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS
AIR-COOLED ENGINES • PRECISION CONTROLS

Circle 60 on Reader Service Card


### Point-of-use Compressor

*Hymatic Engineering Co., Ltd., Redditch, Worchestershire, England*

**Designation:** Model 100 SAS.
**Size:** 7½ cfm at pressures 80-100 psi.



**Applications:** Bracket mounting on machine tools, other industrial machines, motor vehicles and agricultural implements. Particularly suited for operation of air tools, jigs and fixtures, controls, pneumatic brakes, as well as spray painting and lime and insecticide spraying.

Circle 166 on Reader Service Card

### Special Rubber Compounds

*Acushnet Process Company, New Bedford, Massachusetts*

**Service:** Special rubber stocks for molding diaphragms of all types, with or without fabric inserts, from the size of a dime up to three feet in diameter. These special stocks are compounded with properties that effectively resist various fluids and gases, extreme high or low tem-

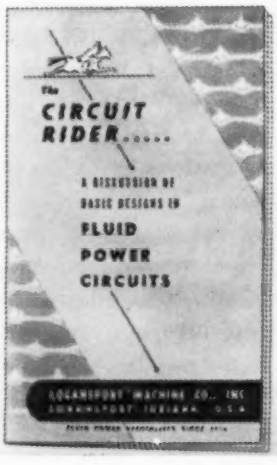
peratures, prolonged flexing, or combinations of these requirements.

**Features:** Acushnet is fully equipped to produce rubber diaphragms bonded to metal. Having developed many new compounding and adhesion techniques, and with greatly enlarged facilities and extensive equipment for bonding rubber to metal, the company can supply diaphragms to customers' specifications. None are stocked as standard items.

Circle 167 on Reader Service Card

## New Manual on Air and Hydraulic Circuits

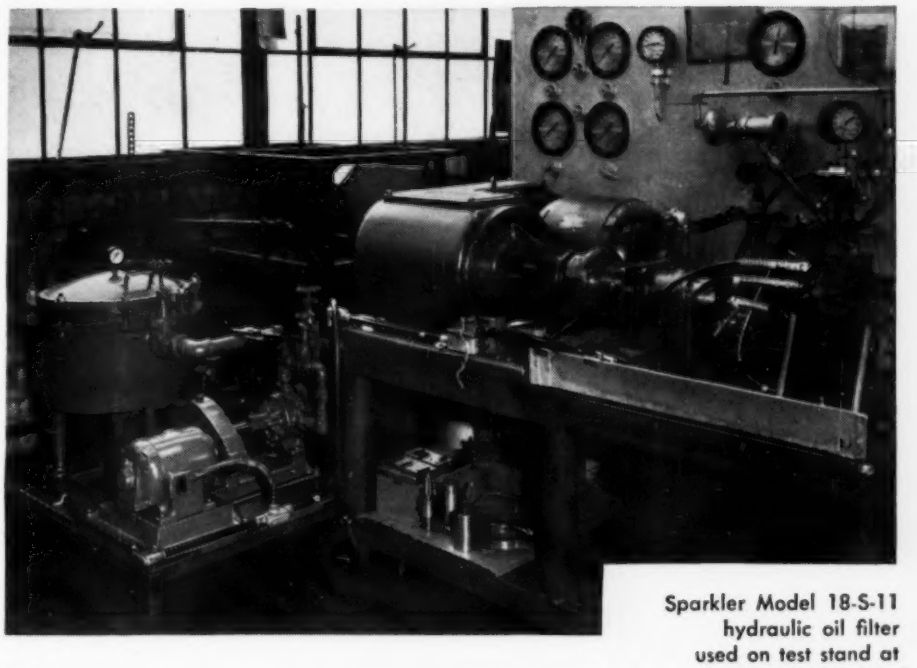
A 32 page pocket-size manual, presenting a discussion of basic designs in fluid power circuits together with drawings, has been published by Logansport Machine Company, Logansport, Indiana. The company has designed and manufactured Logan fluid power production equipment for industry since 1916.




This manual offers a down-to-earth explanation of representative types of fluid power circuits and shows the many possibilities afforded through the use of different types of circuit designs.

Titled "The Circuit Rider", the manual uses J.I.C. symbols and includes an explanation of both pneumatic and hydraulic drawing symbols. Operation of each typical circuit is fully detailed. You can get your copy of this useful manual by writing the Logansport Machine Company or circle number 250 on the reader service card found in this issue.


## "...like SPARKLER hydraulic oil FILTERS best for economical operation and long cycles"



Sparkler Model 18-S-11 hydraulic oil filter used on test stand at Blackhawk Mfg. Co., Milwaukee, Wis.

The Sparkler hydraulic oil filter shown in the accompanying photo is permanently installed on a hydraulic test stand where pumps and valves coming off the production lines are subjected to rigid inspection tests. The filter, a Sparkler Model 18-S-11, operates continuously during test cycles, and serves to remove metal particles, lint, and other impurities that are flushed from the pumps and valves by the hydraulic oil used here. Performance of the unit has been superior in every respect, particularly because of long cycle length and minimum operating expense.

Used as a permanently installed unit, or as portable equipment, a Sparkler filter needs little floor area because of its compact design. It can be cleaned easily in just a few minutes and a complete refill for the average Sparkler filter costs less than a dollar. Most important, a Sparkler filter gives you selective filtration — you pick the degree of filtration best suited to each application, then let the Sparkler filters do the job. All gums, varnishes, sludge, rust and grit are positively removed by mechanical, surface type filtration so that leakage and drainage oils can be reclaimed.

SPARKLER horizontal plate FILTERS

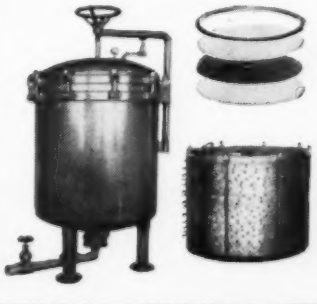
*For more complete information or engineering assistance, write Mr. Eric Anderson*

**SPARKLER MANUFACTURING COMPANY, Mundelein, Illinois**

Sparkler International, Ltd.
Herengracht 568, Amsterdam, Holland

Sparkler Western Hemisphere Corp.
Mundelein, Ill., U.S.A.

*Manufacturers of fine filtration equipment for more than a quarter of a century*



## NEW Sparkler Model VR

This new filter employs an adaptation of the Sparkler horizontal plate to provide exceptionally large area in standard size tank. It is a low-cost unit that is particularly well-suited to hydraulic oil filtration and to any large volume operation.

Ask for new Model VR bulletin.

Circle 105 on Reader Service Card

# Useful Catalogs and Bulletins

## available for reference

**Hydraulic Gauges . . .** A. Schrader's Son offers a bulletin sheet on their new Hydrodial hydraulic gauges with a built-in snubber and calibration ranges as high as 5000 psi. Nine calibration ranges are listed. The gauge uses the direct action principle of Schrader standard gauges. New gauge has a large easily read dial in place of the spring scale used on the standard gauges.

Circle 201 on Reader Service Card

**Small Hydraulic Cylinders . . .** Users and builders of jigs and fixtures have long been looking for a standard line of small hydraulic cylinders which will provide a rugged clamping force. Bulletin 112, recently issued by the Hannifin Corporation supplies data on their new Universal Model U cylinder. These small square mounted cylinders having 1, 1¼ and 1½ in bores may be mounted on the side or either end and can be furnished with mounting flanges or with head and clevis. They are built for service to 1000 psi. This means a 1 inch cylinder will provide approximately 750 pounds holding force. A cutaway drawing and complete dimensional data is included.

Circle 202 on Reader Service Card

**Metallic Packings . . .** A good packing must be pliable to permit self-adjustment and at the same time have sufficient stiffness to provide low friction, long life and freedom from extrusion. These requirements are the basis of the Monopak Metallic Packing design as described in a 12-page Catalog prepared by Hydraulic Accessories Company. The catalog describes the development of this new rod and piston packing for both hydraulic and pneumatic cylinders. Complete design data is given along with dimensional charts and installation data. These packings are made up of pairs of stiff metallic sealing rings, enveloped by pliable elastic cushion rings.

Circle 203 on Reader Service Card

**Protecting Threads . . .** If you are shipping or storing valves, you want a simple, inexpensive means for protecting port threads from damage which may be caused by handling or dirt. Ca-Plugs Division of Protective Closures Co., Inc., Buffalo, has prepared a folder which describes their dust and moisture seals for the protection of hydraulic threaded fittings. The folder lists sizes and prices of these Polyethylene CaPlugs. They fit any diameter as caps or plugs from ⅛ to 1½ in. Special sizes are available up to 3½ in.

Circle 204 on Reader Service Card

**5000 PSI Hydraulic Valves . . .** Where your application calls for high oil pressures, you'll need directional valves specifically built to operate efficiently at high pressures. Munton Manufacturing Co. has issued a bulletin sheet which details the construction of their 4-way valves for 5000 psi operation. These spool type valves are available in spring centered or spring offset models having a capacity of 5 gpm.

Circle 205 on Reader Service Card

**Hose Manual . . .** Pyles Industries, Inc. has prepared an 8-page manual which shows you how to make hose assemblies with the Aro hose coupling machine. Step-by-step illustrations are used. A cutaway drawing details the construction of Aro hydraulic hose assemblies. The manual includes data on how to figure correct length for a hydraulic hose assembly used on either stationary or relative motion installation. Specifications on hose and fittings are put into convenient chart form.

Circle 206 on Reader Service Card

**Hydraulic Power Package . . .** Rivett Lathe & Grinder, Inc., Boston, Mass., has published a new catalog describing its line of hydraulic power units in single pump, double pump, and combination pump types. The Catalog 400 lists all information necessary for efficient pump performance. Besides showing working drawings and specifications for the various sizes of pumps, the catalog contains maximum pressures at a given hp and hp requirements at given pressures. Six tank sizes are available with single pumps and four tank sizes with double pumps. Single pump capacities range from .4 gpm to 40 gpm at 1000 psi. Double pump capacities range from 3.5 gpm to 48 gpm at 1000 psi.

Circle 207 on Reader Service Card

**Dimensional Drawings . . .** Engineers and designers of machined parts are offered a complete handbook titled "Practical Dimensioning" written by E. C. Helmke of the Gisholt Machine Company. The booklet contains a series of blue prints, 26 in all, along with a complete explanation of each. The book provides a splendid guide for good drafting practice which results in drawings which are easily and correctly followed in the machine shop. Sample copies are available.

Circle 218 on Reader Service Card

**Hose and Hose Assemblies . . .** The new Aeroquip Bulletin No. 223 describes, in condensed form many of the company's aircraft products. Included are specifications on Aeroquip hose assemblies, flange type hose fittings and self sealing couplings.

Circle 219 on Reader Service Card

**Flow Meters . . .** A new 40 page handbook has been published by the Fischer & Porter Company to aid in the selection and sizing of variable area meters. This illustrated handbook contains, in condensed form, the results of fifteen years research. A complete description of variable area meters, tubes and floats and their comparison with variable head meters, as well as calibration prediction data has been included.

Circle 220 on Reader Service Card

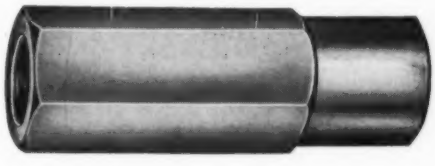
**Air Filter-Regulators . . .** Pneumatic components require protection against dirt and moisture which may enter the system from the air supply lines. M-B Products has prepared literature describing their filter-regulator and Lubricator assemblies for the protection of air valves, cylinders and tools. The bulletin includes parts lists and capacities of available models for ¼, ⅜, ½, ¾ and 1 in pipe lines. Nomographs provide quick selection of the proper size filter and lubricator combination. Nomographs also give the approximate capacities in cfm of free air for all sizes of filter-regulator combinations, regulators alone and filter-regulator-lubricator combinations.

Circle 221 on Reader Service Card

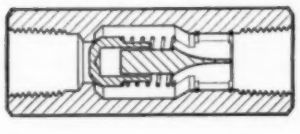
**Snap-Action Switch . . .** Micro Switch, Freeport, Illinois, a division of Minneapolis Honeywell Regulator Company, has just published a data sheet, Number 63, on their "make-before break" snap-action switch, Catalog Listing BZ-2G. Data Sheet 63 describes in detail, with diagrams, the functioning of the two moving contacts in closing the normally-open circuit before the normally-closed circuit is opened. It points out how the make-before-break principle insures continuity in the operation of an electrically controlled multi-stage machine, where a temporary complete break in both would otherwise result in stoppage. Characteristics, electrical ratings, and dimensions of the switch are completely covered.

Circle 222 on Reader Service Card


**CHECK VALVES FOR OIL**



Available in ¼, ⅜, ½ and ¾ inch pipe sizes.



**RELIEF VALVES FOR OIL**

Available in ¼, ⅜, ½ and ¾ inch pipe sizes.

- **LOW PRESSURE DROP**
- **COPPER BRAZED BODY**
  No Gaskets To Leak
  Will Not Come Apart When Fittings Are Removed
- **ECONOMICAL**
- **CONSTANT PRESSURE** (Adjustable)
- **SILENT** (No Whistle or Chatter)
- **LOW COST**

Write today for detailed information.

**FLUID CONTROLS, INC.**

Box 186B Willoughby, Ohio

Circle 32 on Reader Service Card

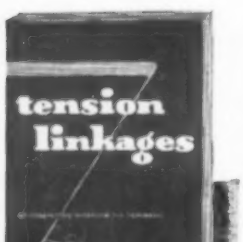
machine designers:

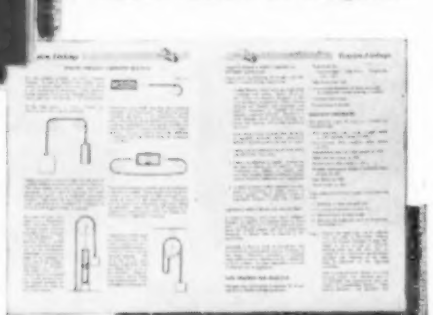
this informative engineering handbook can help you!

If you design lift trucks, hoists, counterweight suspensions, controls, or any type of equipment where you must transmit pull or lift, this informative, free engineering handbook on tension linkages will help you!

It covers typical examples of tension linkage applications . . . helpful step-by-step data on equipment selection and examples to guide you in making your selections. There are tables of dimensional data and other important facts you'll find useful in your work.

Send for your free copy today. Just fill in and mail the coupon below. There is no obligation.



BALDWIN·REX TENSION LINKAGES

BALDWIN-DUCKWORTH
Division of Chain Belt Company
Springfield 2, Mass.

BALDWIN-DUCKWORTH 51-409
Division of Chain Belt Company
399 Plainfield Street
Springfield 2, Mass.
Send me my copy of Bulletin No. 51-10 covering Tension Linkages.

Name .....

Company ..... Dept. .....

Address .....

City ..... State .....

Circle 20 on Reader Service Card

# Air in Hydraulic Systems

Concluded from page 58

Vacuum extraction as above is repeated as often as desired i.e. until the bubble that passes up into M is negligible in volume compared with the air volume already extracted; under average conditions this may be 5 to 10 times.

The pressure equalizing tube permits an oil volume to flow out of M equal in volume to the bubbles of air which rise into M from the working chamber; thus the interior of M is maintained at atmospheric pressure and the volume percentage of air extracted from the oil sample may be read off directly on the scale S.

## *Removal of Air from Hydraulic Pipes*

In order to relieve hydraulic systems of any air which may be present, various venting arrangements have been proposed in the past. These include screw-

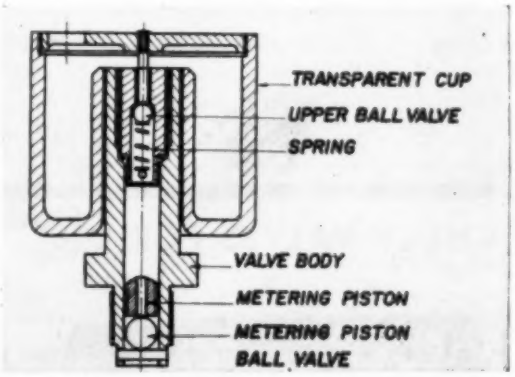



**Fig. 4. THIS AIR RELEASE** valve incorporates a metering device which ejects air at each operation. It is designed to catch oil ejected at the moment of venting.

down pet-cocks, automatic air release valves and manually operated venting valves, etc.

Automatic air release valves tend to "weep" at low pressures and generally only act once each time the system is put under pressure.

A number of manually operated air release valves have been developed at Elswick. They incorporate a metering device which ejects a specific quantity of oil or unlimited amounts of air at each operation. One of these, shown in Fig. 4 is specially designed with a view to hydraulic tidiness as it incorporates a reservoir to catch any oil ejected at the moment of venting.

When the cup, together with the operating plunger is depressed it unseats the upper ball valve. Air and oil which have collected in the cylinder above the piston are ejected into the receiver cup. The lower ball and piston rise and restrict the exit, a small quantity being allowed to leak past the piston and

along grooves in the piston head. When the upper valve is allowed to re-seat, the pressure builds up above the piston and the lower ball drops to the bottom of the cylinder. Oil and any air present at this point in the system pass through the hole in the piston, which drops down to seat again on the lower ball. The arrangement of ball and piston, while keeping small the leak past, allows the valve to reset itself more quickly than does a single piston.

The valve operates satisfactorily at pressures up to 1000 p.s.i., the operating force being moderate. A cylinder full of air and oil is ejected at each operation of the plunger, after which there is a small dribble of oil only if all the air has been exhausted. The time taken for the piston to sink ready for the next operation is 5 to 8 secs.

The valve is clean to operate and almost foolproof as one receiving cup can be used as a master to operate any number of valves. It is assumed that a person would only try to bleed a valve under pressure with a pin or nail—once!

---

# Design of Core Making Machines Uses Air Power

Concluded from page 74

the timer circuits, the three push button switches operate the machine. The main start button is located at the rollover station. This acts also as the emergency stop for the entire operation. The second operator control switch, the core blower and rollover start button is located beside the main start button. The third operator control switch is the core blower, located at the No. 1 station.

### *Average Cycle Time Is 10 Seconds*

Figure 4 is a graphic analysis of the operating time of each of the machine components. The study was based on a cycle of 11.5 seconds on an early model of the machine. The average cycle now is approximately 10 seconds, with several production users, including the one operating the machine cycle analyzed in Figure 4, using working cycles slightly less than 10 seconds.

A trained core maker can turn out about 30 cores per hour on jobs such as automotive cylinder block jacket cores. The core making machine, with two operators can make 360 cores per hour or 180 cores per worker per hour. This is a 600 percent gain. Actually, with rates of 375 cores or more per hour being made, the gain is even greater.

It is no longer true that equipment for the foundry lags behind any other modern production methods. The advantages of uniformly high quality of cores, the elimination of heavy, fatiguing labor and a six fold increase in core production, made possible by the automatic core machine, is a major step in the direction of fully automatic operations in foundries.

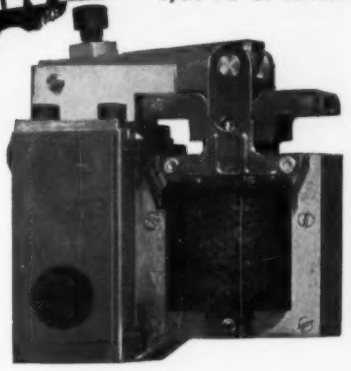
Circle 118 on Reader Service Card

NEW HIGH PRESSURE
SOLENOID VALVES

Now available in 110—220 volts 60 cycle A. C. current

*Features*

- Rugged compact construction.
- 3000 P.S.I. operating pressure
- Continuous duty
- Poppet design eliminates leakage
- May be mounted in any position
- Impregnated coils resist moisture and condensation



**Waterman High Pressure Solenoid Valves** are inexpensive, compact units designed for continuous duty in hydraulic systems where pressures are as high as 3000 P.S.I. Poppet type construction gives positive sealing against internal leakage. Impregnated oil resistant coils make these valves suitable for mounting in oil reservoirs. In many cases this feature eliminates costly piping and makes possible the construction of smaller, more compact hydraulic power units. Available in ⅜" and ¾" pipe size.

WATERMAN ENGINEERING *Company*
725 CUSTER AVENUE • EVANSTON, ILLINOIS

"M-B" AUTOMATIC
*Air Line* FILTER, REGULATOR *and* LUBRICATOR ASSEMBLY

"Sentinel of the Air Line"

*Also Pneumatic Grinders*

*"Remember, Built-in quality remains long after first-cost disappears."*

FILTER element removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR is capable of passing large volume with an unrestricted flow and minimum amount of pressure drop. Self-bleeding, compact, simple. Machined from bare aluminum. LUBRICATOR delivers desired volume of oil. Adjustable Venturi Valve permits efficient operation on broad range of volume and pressure. Bowl can be refilled without shutting off air supply. Any of these 3 devices can be used as separate units or in any combination.

Write for Literature

M-B PRODUCTS
46 Victor Ave.
DETROIT 3, MICHIGAN

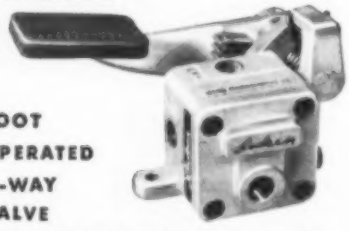
Circle 66 on Reader Service Card

Ledeen
VALVES

**14 Models for Positive, Easy Actuation of Air or Hydraulic Cylinders**

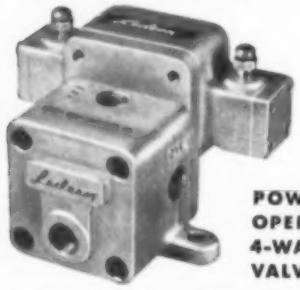
**HAND OPERATED 4-WAY VALVE**

A simple, economical valve, suitable for most requirements. Requires only light turning effort. Built for long life.



**FOOT OPERATED 4-WAY VALVE**

Leaves hands free for other work. Requires only light pedal pressure. Works like accelerator throttle. Particularly valuable for women workers.



**POWER OPERATED 4-WAY VALVE**

For remote control with or without electricity. Can be controlled by microswitch, cam, finger or toe operation.

Ledeen Valves embody the rotating disc construction, and are designed for controlling the flow of air, oil or water. They are made in 14 different models for 5 different cycles, in 6 sizes.

*Write for Bulletin 510*

Ledeen Mfg. Co.
1610 So. San Pedro St.
Los Angeles 15, Cal.

Circle 62 on Reader Service Card

# POST SCRIPTS OF INDUSTRY

## NEWS · VIEWS · TRENDS

**Garvin A. Drew** has been appointed assistant vice-president of the Scovill Manufacturing Company, Incorporated, with respect to the affairs of the **Schrader Division.** He will continue in his capacity as general sales manager. Mr. Drew also serves as a member of the Schrader Division Executive Committee and the Board of Managers.

**J. D. Greensward** has been appointed manager of a newly organized apparatus department at **Allis-Chalmers Manufacturing Co.,** according to an announcement by J. L. Singleton, vice president in charge of the firm's general machinery division. Greensward continues as general manager of the concern's Norwood Works, a position he has occupied since June, 1949. Prior to that he served in an executive capacity in the company's West Allis Works. He has been with Allis-Chalmers since 1922.

**Hall Kirkman,** of Cleveland, Ohio has been elected as a member of the Board of Directors of **The New York Air Brake Company,** it was announced by Bernard Peyton, president. Mr. Kirkham is president and a director of the **Hydraulic Equipment Company** of Cleveland, which was recently acquired by The New York Air Brake Company as a subsidiary.

Bruce H. Atwater, vice-president-sales, of **Pacific Airmotive Corporation,** Burbank, California has announced the appointment of **G. F. Shaver** as merchandise sales manager, and **P. L. Allison,** assistant merchandise sales manager.

**H. J. Hagn** has been elected president and a director of Chiksan Company. **W. Edgar Spear,** former president, has been advanced to Chairman of the Board, and **J. H. Robinson** has been elected a vice president of Chiksan Company and appointed general manager of Well Equipment Mfg. Corp., a division of Chiksan. **Gus M. Bagnard** has been appointed chief engineer of Chiksan Company, he replaces Doyle C. Warren who is returning to his native state of Texas.

**H. J. Hagn**

**E. N. Thomas**

A new Sales Development Department in the **Chiksan Company** has been established. **E. Nelmes Thomas,** formerly assistant manager of the sales promotion division of Commercial Solvents Corporation, has been appointed manager of the new department and will make his headquarters at the company's main plant in Brea, California.

**The British Industries Fair,** England's largest assembly of manufactured products was held May 5 to 16 in London and Birmingham. The Engineering Section, in which many hydraulic and pneumatic product and component manufacturers displayed a wide range of new technical developments was held at Castle Bromwich, Birmingham.

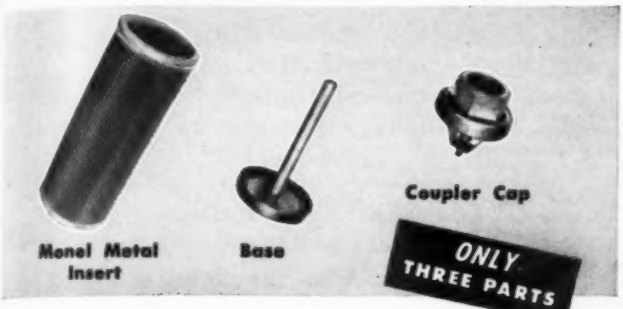
Circle 17 on Reader Service Card

# CAPITAL HYDRAULIC OIL FILTER

***Easy To Install and Maintain***

Avoid costly breakdowns with the new Capital hydraulic reservoir type oil filter which features a non-corrosive, trap-weave wire cloth, giving clean oil at an extremely low pressure drop. Get full protection—various sizes of filter screens can be interchanged in minutes—can be cleaned without taking apart. Its greater filtering area traps all foreign particles and helps to keep your equipment running at top efficiency.

Capital filters designed to J.I.C. standards are available in filtering capacities of 5, 8, 10, 20, 30, 40, and 50 gals. per minute. Larger capacity sizes can be supplied to meet special requirements. Get bulletin AH-1 for complete details.




CAPITAL

*Select territories are available to progressive distributors. Inquiries invited.*

**ENGINEERING & MFG. CORP.**

**5837 South Ashland Ave. • Chicago 36, Ill.**

# BARCO *High Pressure* SWIVEL JOINTS

*for*

# HYDRAULIC SERVICE

***Tubing or Pipe***

**NO BINDING**—A Barco design advantage! "Side Flexibility" in joint compensates for misalignment; simplifies and speeds up installation.

**LEAKPROOF**—A choice of precision-made seals for highest pressures, temperatures, and steam or corrosive service.

**SMALL, LIGHT, COMPACT**—Standard models for ¼", ⅜", ½" and ⅝" O. D. tubing (A/N, flared, or Ermeto) or comparable size pipe threads. Angle or straight connections.

**PRESSURE SAFE**—The seal will not break or blow out suddenly. Built to 3000 psi working pressure standards, steel or aluminum. *Send for literature.*

**BARCO MANUFACTURING CO.**

**1832F Winnemac Avenue, Chicago 40, Illinois**

***In Canada:*** **The Holden Co., Ltd.**

Circle 12 on Reader Service Card

# 3-WAY FULL AREA, PACKLESS SOLENOID VALVES

**SIZES:**
**1, 1¼, 1½ and 2 inches**

We recommend this valve for controlling equipment where pressure must be alternately applied and exhausted as, for example, with diaphragm motor valves, air or hydraulic cylinders, etc. Classed as Bulletin 8331 ASCO Valves, here are a few specifications: pipe sizes 1, 1¼, 1½ and 2 inches. Maximum pressure 125 to 250 pounds; minimum pressure 10 to 20 pounds. Suitable for handling air, water, gas, oil and other non-corrosive gases or liquids up to 180°F.

Since the automatic control of any alternating application and release of pressure is so important for efficient operation, we suggest that you bring your problems to the attention of our engineers. Designing just such controls has been our business for nearly forty years. If Bulletin 8331 Valve doesn't seem to fit your requirements, we have many other types—all in the broad class of automatic control units. Or, if necessary, we shall be glad to design a new type of valve to fit your special needs.

ASCO *Solenoid* VALVES

If you have recurrent and varying needs for automatic control valves, you should have our General Valve Catalog No. 23.

**When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.**

# Automatic Switch Co.

**385-H LAKESIDE AVENUE • ORANGE, NEW JERSEY**

Circle 21 on Reader Service Card

The appointment of **Harry H. Wooden** as controller of **Hydraulic Equipment Company,** Cleveland, Ohio, was announced by Hall Kirkham, president. Wooden, formerly associated with F. C. Russell Company, succeeds Roy W. Swisher, who resigned his post at Hydreco to enter the engineering and contracting field.

The **Hammel-Dahl Company** of Providence, R. I. has appointed **Cowles & Company** of Dallas, Texas as their sales and service representatives in the Central Texas area. In 1923, Clifford A. Cowles organized Cowles & Company and for the past 29 years this concern has been engaged in design and installation of boilers and industrial furnaces, as well as other types of mechanical equipment.

**Arthur Templeton** has been appointed southwestern divisional sales engineer for **Templeton, Kenly and Company** of Chicago. He will make his headquarters at 6505 Aberdeen Ave., Dallas, Texas to cover the states of Texas, Oklahoma and Louisiana.

Circle 85 on Reader Service Card


**George A. Gade,** manager of outside sales for the **Standard Pressed Steel Co.,** has transferred his headquarters from Detroit to the SPS plant in Jenkintown, Pa., near Philadelphia. The move was made preparatory to readjusting the company's nation-wide sales organization because of increased demands for SPS products.

George A. Gade

Gade began his association with SPS as a salesman in 1945 after almost four years as a lieutenant in the Office of Naval Intelligence. SPS assigned him to Chicago from which he was transferred in 1947 to Detroit and made district manager with jurisdiction over parts of Michigan, Ohio and Indiana. He was made regional sales manager in 1949 in charge of the Chicago, Detroit, Cleveland and Cincinnati territories. A year later he was put in charge of sales for the entire country.

**Lundy-Van Goethem & Associates,** 16136 E. Warren, Detroit, Michigan has been appointed the Michigan sales representatives for **Protective Closures Co., Inc.** of Buffalo, New York.

The opening of a new district office in Denver, Colorado, and the appointment of **James R. Hughes** as district manager has been announced by Alan J. Bronold, sales manager of **Sterling Electric Motors, Inc.,** of Los Angeles. Mr. Hughes has had many years of diversified experience as an application engineer for electric power drives. The new Denver office will service the industrial, commercial and agricultural requirements for electric power drives in Colorado, New Mexico and part of Wyoming, Nebraska and Texas.

Circle 99 on Reader Service Card

# Roylyn COUPLINGS

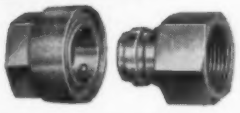
**IMPORTANT FEATURES**

- LIGHT WEIGHT
- QUICK CONNECTING
- POSITIVE LOCKING
- HIGH PRESSURE SEAL
- VIBRATION PROOF
- WIDE TEMPERATURE RANGE
- SIZES FROM ⅛ INCH TO 6 INCH

*FOR MANY VARIED INDUSTRIAL USES:

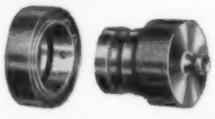
- Railroad Diesel fuel lines
- Marine fuel loading lines
- Tank and Line Pressure Tight Caps
- Processing and Chemical Industries
- Petroleum loading valves and connections
- Liquid transfer and closed hydraulic systems

**OPEN COUPLINGS**



**SELF-SEALING COUPLINGS**

**CAPS & PLUGS**



***Features like these mean CONNECT WITH ROYLYN!***

- ★ *SIZE RANGE* . . . ⅛ inch to 2½ inches. Up to 6 inches in some styles.
- ★ *PRESSURE RANGE* . . . 6600 to 650 P.S.I.
- ★ *MATERIALS* . . . Aluminum alloy, brass, carbon steel, alloy steel and stainless steel.
- ★ *OPERATION* . . . A simple "twist of the wrist"—NO TOOLS REQUIRED!
- ★ *POSITIVE LOCK* . . . Locks with a "snap" and positively will not uncouple with vibration, pressure or rotation of the connected hose.
- ★ *SAFETY* . . . Laboratory tests for extremes of heat, cold, vibration and years of hard service have proven its rugged reliability.
- ★ *VERSATILITY* . . . Open nipple can be used with self-sealing coupling to provide shut-off on one side only. Also open coupling can be used with self-sealing nipple to provide check valve action.

There is a Roylyn Coupling available for practically any type of flexible connection for air, water, hydraulic and chemical applications. Write today for free illustrated catalog and nearest dealer. Inquiries regarding available dealerships are invited.

**ROYLYN, Incorporated**
1700 STANDARD AVE., GLENDALE 1, CALIF.
WUX. TWX GLENDALE, CALIF. 7158

*Roylyn makes Good Connections for You!*

Circle 36 on Reader Service Card

# GAST rotary AIR MOTOR drives agitator for BONDACTOR CEMENT GUN

**PROBLEM:** Design to feed dry sand-cement aggregate uniformly from mixing hopper to airline of Bondactor Cement Gun.

**SOLUTION:** Agitate dry mixture with Gast 4 AM rotary Air Motor driven by compressor which supplies gun.

**RESULT:** Economy, dependability, and needed flexibility in feeding from ½ to 2 cu. yds. of concrete per hour. Unit withstands rough treatment, outdoor use by contractors.

Yes — this is another of scores of design problems *solved* with Gast rotary Air Motors. If rotary air power is a possibility on *your* product, let Gast engineers review your problem. You may profit from their concentrated experience with air power, low vacuum or pressure. Remember, "Air may be your answer!" Write for details.

SEE OUR CATALOG in SWEET'S FILE for PRODUCT DESIGNERS

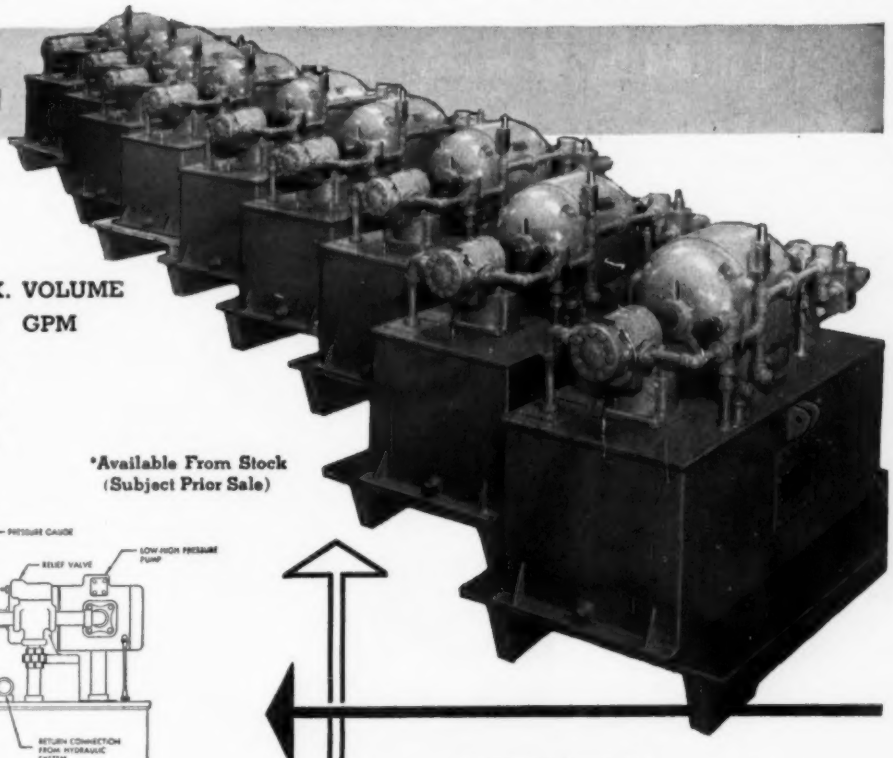
**Gast Application Ideas booklet — showing 26 design problems solved — sent upon request.**

*Original Equipment Manufacturers for over 25 years*

GAST ROTARY AIR MOTORS · COMPRESSORS · VACUUM PUMPS
(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 131 Hinkley St., Benton Harbor, Mich.

QUALITY — A CARDWELL TRADITION SINCE 1829

# CARDWELL

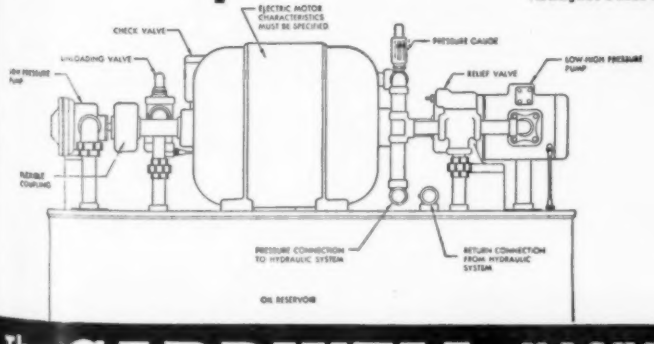


**SRD ROTARY HYDRAULIC POWER UNITS**

PRESSURES UP TO 2000 PSI

| MODEL | MAX. VOLUME |
|---|---|
| SRD 1 - | 12.2 GPM |
| *2 - | 17.8 |
| 3 - | 28.3 |
| 4 - | 41.9 |
| *5 - | 51.8 |

*Available From Stock (Subject Prior Sale)




**SPECIALISTS IN CUSTOM BUILT HYDRAULIC POWER UNITS**

The CARDWELL MACHINE COMPANY
Franklin at 19th St. · Richmond 11, Virginia · Phone: 7-2985

Circle 18 on Reader Service Card

**L. B. Littrell** has been appointed production manager of Pacific Airmotive Corporation, succeeding Luther Harris who has resigned to take over the executive vice presidency of Aircraft Engine and Parts Corporation with headquarters in New York City.

**Stanley D. Margerum** has joined the **R. M. Hollingshead Corporation** as manager of Special Products for the Industrial-Aviation Division. In addition to his duties as packaging specialist Mr. Margerum will assist in the direction of sales on specification corrosion preventives, plastic coatings and industrial specialties for the division.

**Gibson Engineering Company** announces the appointment of **J. F. Clancy** as field engineer covering Rhode Island and southern Massachusetts on electrical, hydraulic and pneumatic equipment. Mr. Clancy was formerly a Lieutenant Commander in the United States Navy and is a graduate of Northeastern University as an electrical engineer.

J. F. Clancy

**The Rucker Manufacturing Co.,** maker of hydraulic power and control systems has moved into larger quarters at 4516 Hollis St., Oakland, California. The new plant contains 12,000 square feet and provides space for machine tools, welding, paint spray booth and assembly lines. This expansion was necessary to meet increased demands for fluid power systems by both government and private industry, according to Clark Rucker, president.

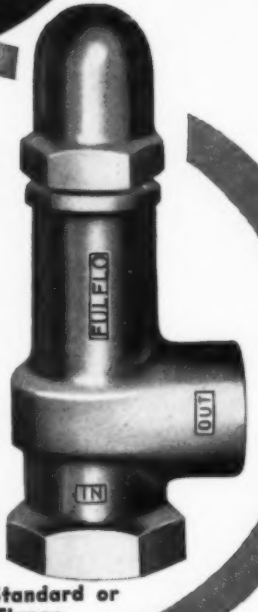

**Select Pressure Needed . . . from 0 to 500 Lbs. Get Uniform, Constant Hydraulic Control**

TRADE MARK "FULFLO" REG U S PAT OFF

OIL BY-PASS RELIEF VALVES

BRASS OR CAST IRON

Pipe sizes: 1/4" to 2"




Standard or Flange

**Simplest and quietest valves on the market!**

Install . . . that's all. No maintenance needed. 5 springs to select pressure.

For ram presses, machine tool hydraulic mechanism, Diesel and oil burning equipment.

NON-CHATTERING
because the cylindrical piston does not seat abruptly against valve. This relieves pounding or chattering noise in valves using conventional seat.

WRITE on your letterhead for FULFLO MECHANICAL DATA BOOK.

FULFLO REG U S PAT OFF — THE FULFLO SPECIALTIES CO. Inc. BLANCHESTER, OHIO

Circle 33 on Reader Service Card


**Edward J. Doucet, Jr.** has been appointed advertising manager of **Vickers, Incorporated,** Detroit, Michigan, according to an announcement made by F. T. Harrington, vice president in charge of sales. Mr. Doucet has been a member of the Vickers organization for eight years. During the past five years, he was in the sales department, most recently as sales engineer in the Detroit district office. For three years previous to that time, he worked in the laboratory and engineering department.

E. J. Doucet, Jr.

**The Cleco Division of the Reed Roller Bit Company,** Houston, Texas, has announced the appointment of Bristol Metal Working Equipment Co., 534 Front St., Hartford, Connecticut; S & M Supply Company, 761 South Seventh St., Grand Junction, Colorado; and Quinn Welding Supply Center, 2725 Chicago Rd., Chicago Heights, Illinois, as distributors for Cleco products in their areas.

Circle 19 on Reader Service Card

# NEW CENTURY RESERVOIRS

*"If it's Hydraulic, Century Designs & Builds Them"*

We specialize in 30 to 500 gal. reservoir units with any makes or combinations from any commercial lines to meet your spec's.

To modernize your present equipment in use now, let us propose our manifolded valve mounting panels to cut down-time.

Our units were designed to meet or to surpass all "J.I.C." standardizations and not copied from other existing similar power units.

## Century Hydraulics

18135 James Couzens Highway • DETROIT 35, MICHIGAN

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Circle 45 on Reader Service Card

# new! revolutionary! Pilot-Master AIR CONTROL VALVES

*Ingenious Design • Many Applications*

HANNIFIN ANNOUNCES
A New AND Better WAY TO CONTROL AIR PRESSURE IN OUR P-M LINE
Pilot-Master Valves
HANNIFIN Corporation

New piston-operated poppet design in 2, 3 and 4-way Master and Pilot-Master Valves—also 10 new Pilot Valves for remote control.

**ADVANTAGES**

- Unique Removable Cartridge
- Fewer Valves to Stock
- Fewer Parts to Stock
- All-Electric or All-Pneumatic Hook-Ups

GET THE FULL STORY

All Sizes 1/4" to 1 1/4"

Every Design Engineer and Tooling Specialist will want Bulletin 231—just off the press. Contains full details on the complete P-M line.

## HANNIFIN

Hannifin Corporation • 1155 S. Kilbourn Ave., Chicago 24, Ill.

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# STOP downtime, costly repairs on HYDRAULIC EQUIPMENT

*with World-Famous*

## HONAN-CRANE oil purification

**70% OF TROUBLE ON HYDRAULIC EQUIPMENT IS CAUSED BY OIL CONTAMINATION AND FAILURE**

Honan-Crane Purifiers prevent trouble before it starts in hydraulic installations by keeping oil clean and free from damaging contamination. When used to replace ineffective methods or where no purification program has been practiced previously, 50% reduction in hydraulic maintenance costs and 4 to 5 times the former safe oil life are common experiences.

Honan-Crane Purifiers prevent excessive wear of hydraulic pump parts . . . prevent clogging and sticking of control valves, pistons and other hydraulic mechanisms . . . greatly extend the safe-use life of hydraulic oils. Specify Honan-Crane Oil Purification for your hydraulic equipment. Proven by years of dependable service throughout the world . . . there's no reason to settle for less!

***FREE!*** 8-page "Hydraulic Bulletin" with case histories describing profitable advantages of Honan-Crane Purification in many critical hydraulic applications. Write for your copy!

550 gallon hydraulic system of world's largest injection molding press (300 oz.) gets Honan-Crane oil purification regularly at Amos Molded Plastics, Edinburg, Indiana. Hydraulic equipment at Amos Plastics has been protected by Honan-Crane Purifiers since 1942.

## Honan-Crane Corporation

102 Wabash Avenue, Lebanon, Indiana

*A Subsidiary of*

**Houdaille-Hershey Corp.**

WORLD'S LEADING OIL FILTER MANUFACTURER

© 1952 HONAN-CRANE CORP.

Circle 47 on Reader Service Card

# QUADRUPLES
## PRESSURE RESEARCH
# EFFICIENCY
## AT ✻ CO.

Internationally known development company saves time and money in solving fuel injection problems on modern aircraft engines. Special EPL PRESSUREGRAPH *simultaneously* measures and records four individual pressure-time phenomena of dynamic, static or transient pressures on the 4-beam cathode-ray oscilloscope.

Pressure impulses from four electronic pick-ups are carried to four individual Pressuregraphs where timing and positioning markers from the Electro Syncro-Marker are superimposed. All four pressure impulses, with markers, are amplified and can be viewed or photographed directly for quick, accurate analyses.

***Have EPL help you save time and money by engineering a composite instrument for your particular requirements.***

***Name upon request.**

*Send Coupon for Details Today!*

**ELECTRO PRODUCTS LABORATORIES**
4501-Hp North Ravenswood Ave.,
Chicago 40, Ill.

*Name* .....

*Firm* .....

*Street* .....

*City* .....*State*.....

*Precision Instruments Since 1944*

Electro ELECTRONIC EQUIPMENT

*Makers of the*
**DYNAMIC MICROMETER**

Measure dynamic or static displacement, vibration or movement of any metal body **without** physical contact.

SALES ENGINEERS IN PRINCIPAL CITIES

Circle 30 on Reader Service Card


**Precision Rubber Products Corporation** of Dayton, Ohio has announced the promotion of **Edward N. Cunningham** to the position of assistant sales manager. Mr. Cunningham joined the firm's Technical Sales Staff in January, 1951. Prior to that, he was with the B. F. Goodrich Company, Akron, Ohio and later with the Rubber Division of Enjay Company Inc., New York, as Technical Sales Representative. He was closely associated with the early development of Nitrile and Butyl types of synthetic rubbers.

**E. N. Cunningham**

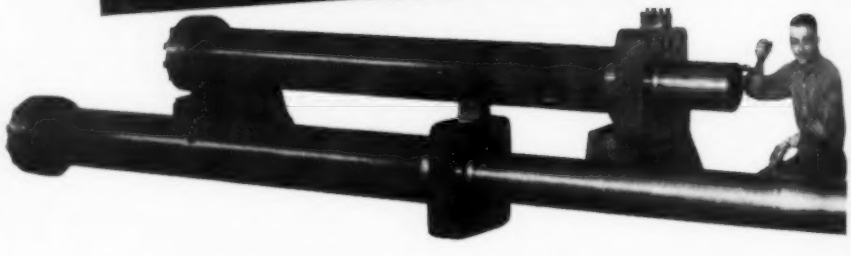
His experience has included both sales and technical service work, much of which has been with the specialty synthetic rubbers. He served on a number of technical committees, whose chief function was to develop rubber specifications for the automotive and aircraft industries.

**Republic Manufacturing Company,** 1930 West 77th Street, Cleveland has acquired industrial and aircraft valve lines created and manufactured by the Parker Appliance Company over the past twenty years.

**Wilbur H. Norton,** vice president of General Motors, was named president and member of the board of **R. M. Hollingshead Corporation** of Camden, N.J. Stewart Hollingshead, president since 1945, became chairman of the executive committee. R. M. Hollingshead, Jr., remains as chairman of the Board of Directors, and T. J. Bagley as executive vice president. Norton will have direct charge of plans and policies in expanding the company's activities.


# They're BIG...
## in size and performance

**COLUMBIANA OILDRAULIC CYLINDERS**
**11" BORE x 102" STROKE x 2000 PSI**



Regardless of size, bore, stroke and pressure requirements, COLUMBIANA ENGINEERING is completely equipped to design and build hydraulic and air equipment to meet your specifications.

- **Hydraulic and Air Cylinders**
- **Hydraulic Power Units**
- **Accumulators and Intensifiers**
- **Hydraulic Presses**
- **Forging Manipulators**
- **Charging Machines**
- **Special Hydraulic Machinery**

*Catalog Available* •

*Get prompt practical help on your needs by writing today to:*

**COLUMBIANA ENGINEERING COMPANY**
115 East Salem Street—Columbiana, Ohio

Circle 23 on Reader Service Card

Circle 88 on Reader Service Card

# IN LEATHER PACKINGS... Only PHILAPAC CAN GIVE YOU Lifetime Lubrication*

* The unique Philapac Formula-37 for "lubrication of leather for life" assures leather packing action that actually outlasts the application.

Simply state the condition—let PHILAPAC, the leather packing that's kept pace with the times, do the rest!

*Lifetime Lubrication* is one reason why you can count on PHILAPAC for more. *Tailored Performance* is another . . . both lubricant and leather *matched* to the service conditions *as you define them!*

No downtime, no lapse in performance . . . because Philapac Formula-37 builds permanent lubrication into the inner pores of every fibre!

*Write for complete data on PHILAPAC all shapes — all mold sizes to 5 ft.*

PRODUCT OF

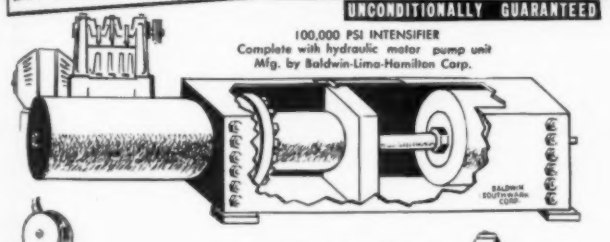
**PHILADELPHIA Belting Company**

SIXTH & SPRING GARDEN STREETS • PHILADELPHIA 23, PA.

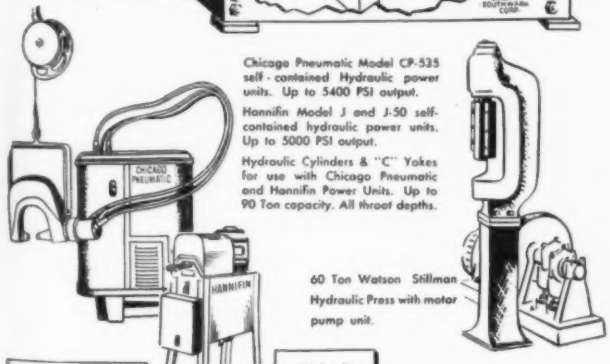
PHILAPAC IN PACKINGS PHILABELT IN BELTING

# Immediate Delivery- on HYDRAULIC EQUIPMENT

UNCONDITIONALLY GUARANTEED



100,000 PSI INTENSIFIER
Complete with hydraulic motor pump unit
Mfg. by Baldwin-Lima-Hamilton Corp.



Chicago Pneumatic Model CP-535 self-contained Hydraulic power units. Up to 5400 PSI output.

Hannifin Model J and J-50 self-contained hydraulic power units. Up to 5000 PSI output.

Hydraulic Cylinders & "C" Yokes for use with Chicago Pneumatic and Hannifin Power Units. Up to 90 Ton capacity. All throat depths.

60 Ton Watson Stillman Hydraulic Press with motor pump unit.

Hydraulic Cylinders in all sizes. Heat Exchangers, Fittings, Valves, Etc.

Hy-Mac Hydraulic Power Units. Up to 1000 PSI & 38.5 GPM output.

Miller Portable Hydraulic Test Bench. Up to 3000 PSI. Electric and/or manual operated.

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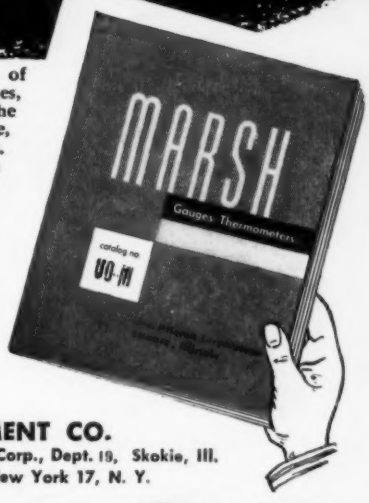
# Know the scope of the MARSH line of pressure gauges

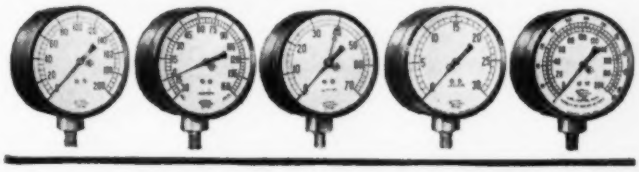
There are literally thousands of combinations of types, ranges, case styles and connections in the broad Marsh line of pressure, vacuum and compound gauges. As a result, gauge requirements that would be "special" to others are often standard to Marsh.

This means that we can meet your gauge needs better and more economically . . . whatever the service condition, quantity or design requirement. To know the scope of Marsh Instruments just ask for the new fact-filled catalog.

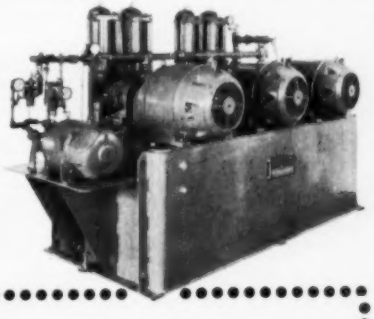



**MARSH INSTRUMENT CO.**

*Sales affiliate of* Jas. P. Marsh Corp., Dept. 19, Skokie, Ill.
Export Dept.: 155 E. 44th St., New York 17, N. Y.



# HIGH CAPACITY HYDRAULIC POWER UNIT



The unit illustrated furnishes hydraulic power for payoff and tension reels in the country's most up-to-date steel plant processing lines. Unit has sufficient capacity for handling 60,000 pound coils at the specified high line speeds, with automatic pressure holding and pump unloading devices.

Two of the main pumps are used for operation, the third is for standby service. The small auxiliary pump and accompanying valves furnish hydraulic power and control for maintaining strip edge register during payoff cycle.

Brief specifications show that reservoir capacity is 600 gallons, pump capacity 3-60GPM, Accumulator capacity 4-10 gallon Hydro-Pneumatic. Control of Accumulator circuit and unloading of pumps during idle cycle is by means of pressure switch and solenoid controlled relief valves at each pump.

Your inquiries for custom designed and standard power units will receive immediate attention.

Standard reservoirs in capacities 40, 60, 80, 100, 200, 300, 400, and 600 gallons.

**"HYPECO"**

**HYDRAULIC POWER EQUIPMENT CO.**

*Custom & Standard Hydraulic Power Units*

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(Youngstown Suburb)

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"Sealol" — the balanced pressure seal — is in service on all types of rotary shaft sealing applications — on all types of products. If your sealing problem involves fuel pumps, hydraulic motors, transfer pumps, centrifugal pumps, gear boxes, speed reducers, agitators, gas turbines, superchargers, compressors, washing machines, natural gas flow meters, or virtually any other type of product requiring a rotary shaft seal — "Sealol" has specialized experience and knowledge to help you.

For example, "Sealol" is sealing a ¾" shaft rotating at 36,000 RPM against kerosene at 200°F. and 300 psi. Another application is on a ½" shaft at 70,000 RPM, sealing out oil mist and air at 230°F. and 19" Hg. abs. "Sealol" is also sealing a 6½" shaft at 4 RPM against SAE 10 lube oil at 1125 psi. This gives you an idea of the scope of our engineering and production background.

Chances are we have the answer to your sealing problem. Let our engineering department go to work for you. Send blueprints and specifications to Sealol Corporation, 45 Willard Ave., Providence 5, Rhode Island. Plants No. 1 and No. 2 in Providence. Plant No. 3 in Keene, N. H. Offices in Philadelphia, Cleveland, Chicago, Los Angeles, Montreal, Toronto.

**SEALOL**

**The Balanced Pressure Seal**

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**B. N. Ashton,** president, **Electrol Incorporated,** manufacturers of aircraft and industrial hydraulic devices, Kingston, N. Y. announces the appointment of **Victor E. Fletcher**, executive assistant, as assistant to the president and assistant corporation secretary.

**V. E. Fletcher**

**E. B. Holland**

**G. D. Logan**

**H. B. Smith**

Mr. Ashton also announces the appointment of the following who will serve as vice presidents: **Howard B. Smith,** sales manager; **Edmund B. Holland,** manager of development and engineering; **George Dewey Logan,** plant manager and **Rudolph Ratschitzky,** secretary and treasurer. Each of the new appointees has been associated with the company for over five years, moving up through the ranks to his present position.

**W. J. Van Vleck,** present manager of the corporation's Atlanta District Sales office succeeds Mr. Hood as manager of the New York district sales office. **C. W. Kramer,** resident general line salesman in Birmingham, Ala., will succeed Mr. Van Vleck as manager of the Atlanta office. **I. W. Leggett,** general line salesman at Charlotte, N. C. has been appointed manager of the Charlotte branch office.

According to an announcement by W. H. Feldmann, vice president in charge of sales, **Worthington Pump and Machinery Corporation** has elected **C. K. Hood,** formerly manager of the corporation's New York district sales office, to a vice presidency. He will be responsible for the direction of the activities of the Public Works, Steam Power, Deaerating, Water Treating, and Steam Turbine Divisions and will report to T. Cruthers, vice president.

The appointment of two new district representatives has been announced by Lewis L. Dollinger, Jr., sales manager of the **Dollinger Corporation,** Rochester, N. Y., manufacturers of air and oil filters. **Sabel E. Baum,** Dixie Engineering Co., Birmingham, Ala., has been appointed district representative in Alabama, western Florida and Marion, Hamilton Bradley and Polk counties, Tennessee. Mr. Baum has been actively engaged in industrial design and sales engineering.

**Roy A. Stipp** of Greenville, S. C. has been appointed district

**R. A. Stipp**

**S. E. Baum**

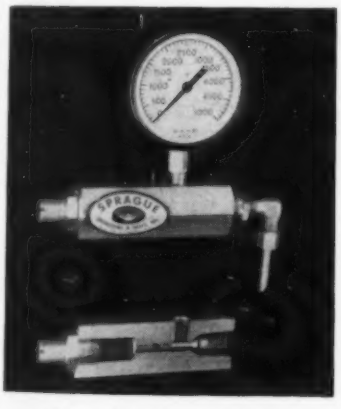
representative for North Carolina, South Carolina and Eastern Tennessee. Since graduating from the University of Kentucky in 1928, Mr. Stipp has been in the sales engineering field. He started his own business as manufacturers' representative in 1945.

Fred T. Miller vice president of **Adel Division,** General Metals Corporation has announced the appointment of **Lawrence C. Immel** as sales engineer in the mid-west area. Mr. Immel will assist Donald E. Flinn in providing customer engineering service. Their headquarters are in the Hulman Building, 120 West Second Street, Dayton, Ohio.

Arnold J. Werner of the **Arnold J. Werner Co.,** 502 New Center Bldg., Detroit 2, Mich., has been appointed distributor for the state of Michigan by the **Superior Hydraulic Division,** Superior Pipe Specialties Co., Cicero, Ill.

The Racine Tool & Machine Company, Racine, Wisconsin has moved into a newly modernized plant comprising some 50 per cent increase in manufacturing floor space. Along with its move into the new quarters the company has changed its name to **Racine Hydraulics & Machinery, Inc.,** 2000 Albert Street, Racine, Wisconsin.


**GAGE PROTECTOR . . . shut off valve saves gages**



Gage is always Safe.

Automatically cuts out gage from system when hydraulic or pneumatic pressure goes beyond its operating limit. Automatically opens when pressure is again within operating range of gage. Available for low pressures—30, 60, 100, 200 and 300 PSI. and high pressures—500, 1000, 1500, 2000, 2500, 3000 and 5000 PSI. Sprague Gage Shut Offs installed in a hydraulic system with multiple gages of various ranges, save valuable man hours. They eliminate the necessity of the operator opening and closing manually operated shut off valves for the various gages in the system. Supplied with standard pipe thread connections but can also be furnished with AN adaptors for aircraft fittings. Connection to the system is made at the end of shut off, 1/2" pipe thread. Connection to gage is made on the side of shut off, 1/4" pipe thread. Overall length 5 1/2 inches. Body is 1 1/2 inch hexagon stock. Finest construction. Individually tested and approved. Write today for bulletin.

**SPRAGUE ENGINEERING & SALES CORP.**
**1144 West 135th St., Gardena, Calif.**

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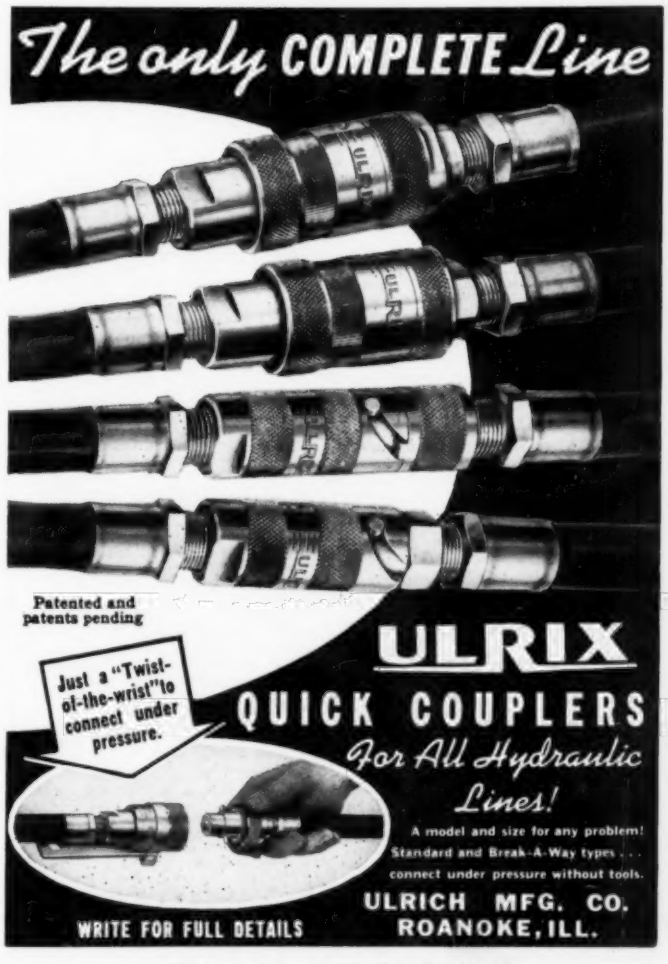
The only COMPLETE Line
Patented and patents pending
ULRIX
QUICK COUPLERS
For All Hydraulic Lines!
Just a "Twist-of-the-wrist" to connect under pressure.
A model and size for any problem! Standard and Break-A-Way types . . . connect under pressure without tools.
WRITE FOR FULL DETAILS
ULRICH MFG. CO.
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## What's Being Said About J.I.C. Standards

Continued from page 45

understood once the alphabet of symbols has been learned. Mr. Robinson has only one objection to the symbols. He believes that when one line passes another and no connection exists between them, a loop or semi-circular jumper should be used rather than a simple cross.

**Kurt O. Tech,** Chief Engineer, *The Cross Company . . . the machine tool builder's viewpoint*

**About the need**—Production methods have grown to include large multipurpose machines which require power systems for automatically locating and clamping the work, for feeding the work or the cutting tools, and for handling materials. These large transfer machines emphasize the importance of building hydraulic systems which are safe, have components which are readily accessible and therefore easy to maintain.

Before standards, the indirect labor costs due to increased maintenance and tool setting on many multi-purpose hydraulically powered machines were getting out of line. The J.I.C. standards offer good engineering and construction practices aimed toward safety and accessibility.

**Source of information**—In order that he may design and build machines to meet the users requirements, the machine tool builder needs a dependable source of information from the user, J.I.C. standards have, for the first time, given the builder information on those portions of the hydraulic circuit which present difficulties to the user.

**Redesign goals**—In redesigning machines to meet and exceed the standards, there are four definite goals. First, provide an accessible pump; second, make the replacement of cylinder packings a job which takes minutes instead of hours; third, separate the electrical and hydraulic maintenance problems; fourth, remove as much piping as possible from the unit, replacing outside piping with manifolds.

**Machine builder's attitude**—Consider the standards as a complete service report and look for the intent behind the standards so that the final design exceeds the minimum standards as outlined by J.I.C. The standards point out minor and important trouble spots. They do not restrict design or inhibit the ingenuity of the builder.

**Arthur McHugh,** Control Application Engineer, Lincoln-Mercury Division, Ford Motor Company . . . *the industrial equipment user's viewpoint.*

**Purpose of standards**—To the industrial equipment user the primary reason for J.I.C.'s existence is to eliminate excessive production downtime.

**Before standards**—The user found that many machine builders were putting the importance of appearance before ease of maintenance. The machine base was used as the oil reservoir and in many designs the pump and valves were placed in the reser-


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SPECIAL BARGAIN
#29 HYDRAULIC CYLINDER

Gives 20,000 lbs. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lbs. thrust with 3,000 lbs. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1¾" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road farm and shop machinery, presses, etc. Cost Government $390.00 . . . . . NOW 29.95

3A HYDRAULIC CYLINDERS
NO. 3A – Bore 1½", Shaft ½" Stroke 5", Length 10½" . . . 7.75
NO. 9E – Bore 1-3/8", Shaft 1" Stroke 15-5/8", Length 15½" . . . . 9.75
NO. 3S – Bore 1½", Shaft 1" Stroke 26", Length 23½" . . . . . 16.50

AN-Hi-Press HOSE (FUEL–OIL & AIR)
1/4" Tube Size – 7/16 x 20 Thread – 16" long with Male and Female fitting at either end. . .95¢ each.
1/4" Tube Size – 7/16 x 20 Thread – 22" long with Female fittings at both ends. . . . . .95¢ each.
3/8" Tube Size – 9/16 x 18 Thread – 20" long with Female fitting at both ends. . . . . $1.90 each
Same as above but 63" long. . . . . $3.75 each
1/2" Tube Size – 3/4 x 16 Thread – 24" long with Female fittings at both ends. . . . . $2.25 each
Same as above but 67" long. . . . . $3.75 each
5/8" Tube Size – 7/8 x 14 Thread – 15" long with Female fittings at both ends. . . . . $2.25 each.

FOUR WAY VALVE
V-17 Poppet type. Pressure balanced. Off at neutral position. Piston type with built-in relief valves for limit of cylinder strokes. Has 5/8" AN tube size (7/8"–14 thread) inlet and outlet. Ports to the cylinder are 1/2" AN tube size with 3/4"–16 thread. Many more in stock. Send for list. 9.75

HYDRAULIC TRANSMISSION
Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever.) supplying piston hydraulic motor. Automatic pressure, Dash pot for smooth control. Power output R.P.M. – 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 37.50

HYDRAULIC PUMPS
ANGLE PUMP
Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM. Intermittent maximum 4500 RPM. Rotates to the right only. . . . . 19.49

P-3 STRATO POWER PUMP With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. Two gal. per minute capacity at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous. 1400 PSI for 15 seconds. Operates at 3750 RPM, intermittent max. 4500 RPM. Rotation either direction without adjustments. NEW 19.50

HYDRAULIC ACCUMULATORS
A-28 FLOATING PISTON TYPE – 4" dia. X 18" long. Handles pressures up to 2000 lbs. X-Int. Cond. 12.75
4-S VICKERS – 10" dia. Built to stand 2,000 PSI. 19.75
Accumulators are used for constant pressure, both in line and reserve storage for instant use to take the lag from the pumps.

We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for inform.

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## MUNTON cylinders and valves safely handle all loads up to 5000 p.s.i.

5000 P.S.I. HYDRAULIC CYLINDER

1. SPACE SAVING 4" cylinder at 5000 PSI develops 60,000 lbs. pressure. An 8" cylinder at 1000 psi develops only 50,000 lbs.

2. ALL-STEEL construction.

3. Sizes: 1½" to 6" ID.

4. The only cylinders with FELT WIPERS on BOTH ENDS of piston, ahead of the piston rings, to wipe the walls of the cylinder as the piston moves in either direction . . . insuring LONGER LIFE and reducing chances of scoring.

5. A double seal arrangement with port for a drain-back to tank, to eliminate annoying seepage around piston rod.

6. Munton Special "V" type combination rubber and leather packing to insure lubrication along with sealing.

7. Chrome-plated piston rods; long piston for ample bearing surface; cast-iron piston rings; and all JIC features.

8. Valves include: 4-Way; adjustable pressure control; safety valve; check valve; unloading valve; and sequence valve. All-steel construction eliminates danger of sand from cored holes working loose and getting into system to score cylinders and valves. All valves made for 5000 PSI.

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**MUNTON MFG. CO.**

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Phone: Gladstone 5-2618


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voir submerged in oil. Lubricating oil often contaminated hydraulic oil. Copper tubing and brass fittings were used having variable flare-angles, and piping runs were inadequately supported. Circuit diagrams were inconsistent—each machine builder had his own symbols and method of specification. Often the user had to trace the circuit without benefit of a drawing—this invariably led to trouble.

**After standards**—Continuous oil care has been provided by the use of filters. Manifolds and gasket mounted valves have simplified and speeded maintenance and have reduced downtime previously caused by machine vibration and system contamination. Clean out doors are built into the machine; tube fittings now have a standard 37° flare. Users have found that with a good filter and a sealed reservoir, the hydraulic components will give long trouble-free service.

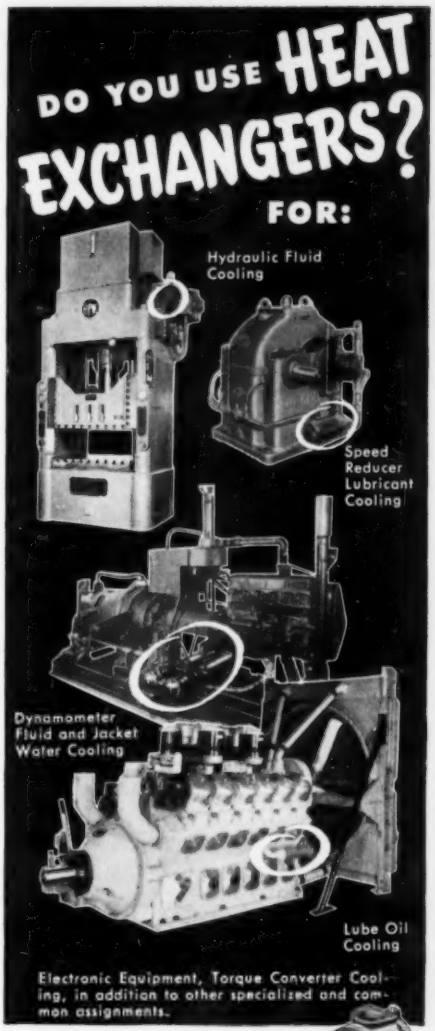
Because of standards, the user has no difficulty in determining sequence of operation, tracing the flow path, determining piping sizes, knowing the related electrical equipment and having complete identification of components.

## Air Cylinders Control Flow In Filtration Plant

Concluded from page 59

at approximately 50-60 psi, the average pressure of the plant service lines.

The function of the back wash operation is to float away the dirt entrapped in the top layer of the filter bed. Two 16,000,000 gallons per day centrifugal pumps, deliver water from the wash water tanks to a pressure chamber under the filters. The pressure is very low (7psi), sufficient, however, to quickly clear the filter bed. Back washing is done whenever the loss of head, indicated on the table dial, reaches a predetermined resistance in feet. Under normal conditions, a filter back wash is required for each 30 to 60 hours of filter operation. The actual back wash time is only a few minutes, the operation being stopped when the water rising from the top of the filter bed is clear.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Illustrated: Young Type "F" two-pass Shell and Tube Heat Exchanger with fixed tube bundle.

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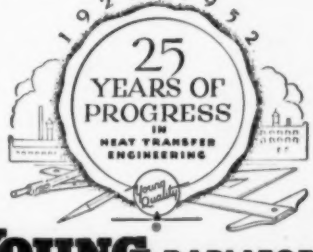


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**The HY-LO-JACK UNIT offers you—**

- Automatic Operation in place of slow, costly manual methods.
- 1,000 Lbs. per sq. inch pressure.
- One gallon per minute volume.
- Operates efficiently on less than one horsepower.
- Operates at direct-connected motor speeds; or Vee pulley.
- Priced for the most conservative budget.

*Write NOW for complete details to—*

**MONARCH ROAD MACHINERY CO.**
*Hydraulic Division* 327-29 FRONT AVE., N. W. GRAND RAPIDS, MICHIGAN

## Norgren Shows New Plant

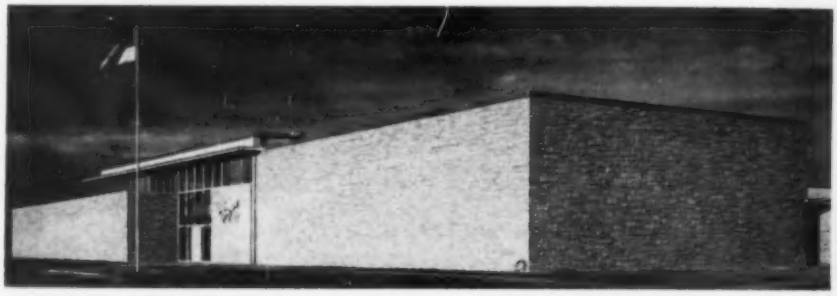
The new home of the C. A. Norgren Co., Englewood, Colorado was formally opened late in February.

Behind its beautifully designed and constructed front elevation of red Boulder sandstone and non-reflecting, polished plate glass is a plant area of more than 2½ times the old structure. Total area of the new building is more than sixty thousand square feet.

The production sector is laid out on a flow plan and integrates two complete manufacturing divisions—machining and assembly. Each division has its own stock room—raw materials stock for the machine shop, finished parts stock for the assembly division.

In effecting the overall production efficiency, some of the important features are: improved material handling procedures, numerous new production machines and modern illumination throughout. A specially designed carton chute from an overhead stock area to the packing benches is a new and outstanding feature.

A unique beauty feature of the Norgren plant is the magnificent 100 mile wide panorama view of the Rocky Mountains that is seen from the flagstone patio at the entrance to the plant.



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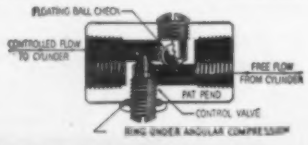
**for Cylinder Speed Adjustments**
**OVER A WIDE RANGE**
**IN AIR OR HYDRAULIC USE**

The Pneu-Trol Flow Control Valve combines an efficient Stainless Steel FLOATING BALL CHECK which opens and closes at the slightest change in flow direction; with a Vernier Type VARIABLE NEEDLE ORIFICE adjustment in a compact control which has widened air and hydraulic cylinder application by providing precise control of cylinder action. Modifications of the Pneu-Trol Valve are available as Plain Check, check with Fixed Orifice (orifice drilled by customer in the Standard Check Valve), Needle Valve and Velocity Limiting Check. All Pneu-Trol Valves are made from bar stock in brass (up to 1000 psi) or steel (5000 psi) or other body metals to your specifications. All internal parts are Stainless. All valves available in 5 sizes—⅛", ¼", ⅜", ½", and ¾".

***Attractive prices — Immediate delivery. Write for illustrated circular and price list.***

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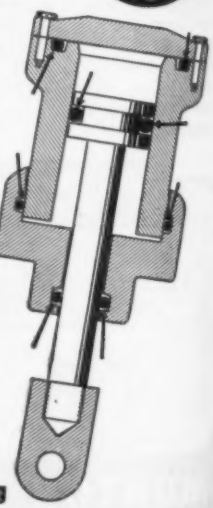
***Dependable Hydraulic Seals***

**Minnesota O-Rings function in air or gas systems as well as in hydraulic systems. Air cylinders . . . hydraulic valves . . . hoisting mechanisms . . . water pumps . . . bottling machines . . . refrigerators . . . motors . . . lubricators . . . are a few of their uses. Minnesota's exclusive injection process makes possible very close dimensions, uniformity in mass production and downright economy. We use special compounds of synthetic rubber to meet your exact requirements. Let us quote on your next hydraulic packing installation.**



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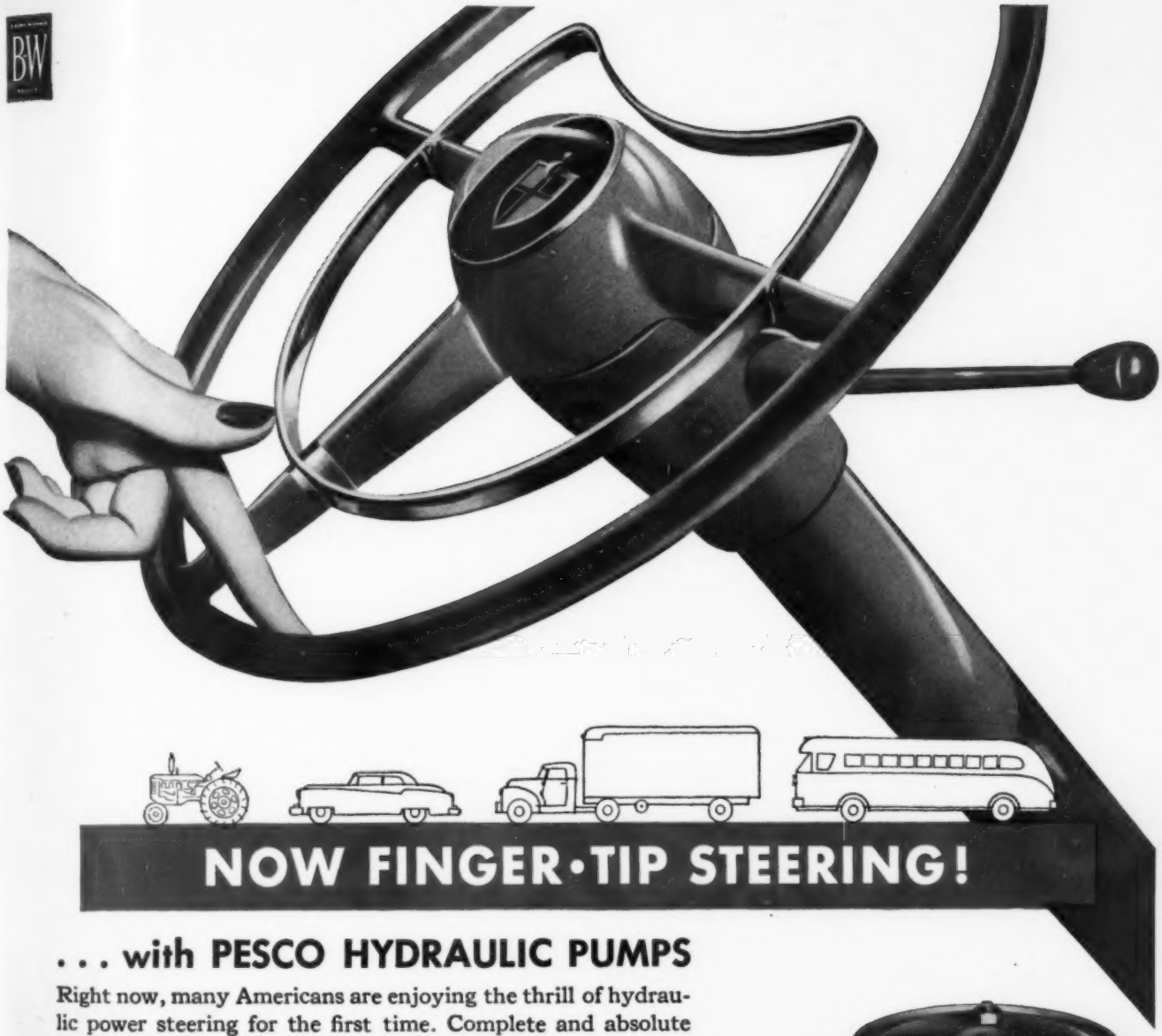

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Less driver fatigue and increased pay loads for truckers are just two of the many benefits of hydraulic power steering.

Pesco engineers have worked hand in hand with automotive engineers in the development of a pump for this unit, which is one more in a long series of important developments in the field of *pressurized power and controlled flow*.

Investigate the advantages of hydraulic power steering for the vehicles you manufacture. Perhaps Pesco's experience can be helpful to you. Why not call us?

New Pesco Hydraulic Power Steering unit for passenger cars consists of pump and reservoir.

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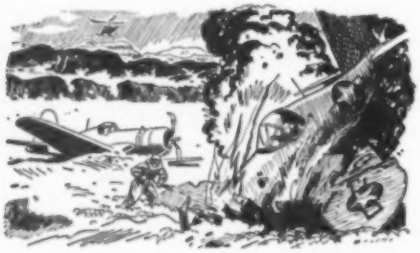
IT WAS A BRIGHT EARLY DECEMBER DAY and Lieutenant Hudner was flying a Korean combat mission alongside another plane piloted by Ensign Jesse Brown. A burst of flak



caught the ensign's plane and he went spinning down, aflame. Lieutenant Hudner then deliberately crash landed near his flame-trapped shipmate. He radioed for help, after which he fought to keep the fire away from the fatally injured ensign until a rescue helicopter arrived. Today Lieutenant Hudner says:

"Maybe if America had been strong enough to discourage aggression two years ago, my friend, Jesse Brown, might be alive right now. So might thousands more of our Korea dead.

"For it's only too sadly true—today, in our world, weakness invites attack. And *peace is only for the strong.*

"Our present armed forces *are* strong—and growing stronger. But don't turn back the clock! Do your part toward *keeping* America's guard up by buying more . . . and more . . . and more United States Defense Bonds *now!* Back us up. And *together* we'll build the strong peace that all Americans desire!"

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**Peace is for the strong...**
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Lt. (jg) Thomas Hudner, Jr. U. S. N.

Medal of Honor

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